U. S. DEPARTMENT OF AGRICULTURE.

TWENTY-FIFTH ANNUAL REPORT

OF THE

BUREAU OF ANIMAL INDUSTRY

FOR THE YEAR

1908.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1910.

[STATUTES AT LARGE, VOL. 28 (CHAP. 23), P. 601.]

AN ACT Providing for the public printing and binding and the distribution of public documents.

SEC. 73. Extra copies of documents and reports shall be printed promptly when the same shall be ready for publication, and shall be bound in paper or cloth as directed by the Joint Committee on Printing, and shall be the number following in addition to the usual number:

Of the report of the Bureau of Animal Industry, 30,000 copies, of which 7,000 shall be for the Senate, 14,000 for the House, and 9,000 for distribution by the Agricultural Department.

Approved, January 12, 1895.

LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Animal Industry,
Washington, D. C., July 28, 1909.

Sir: I have the honor to transmit herewith the Twenty-fifth Annual Report of the Bureau of Animal Industry, for the year 1908, and recommend that it be published, as provided by section 73 of the act of Congress approved January 12, 1895.

Respectfully,

A. D. Melvin,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

ORGANIZATION OF THE BUREAU OF ANIMAL INDUSTRY

Chief: A. D. MELVIN.
Assistant Chief: A. M. FARRINGTON.
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Pathological Division: JOHN R. MOHLER, chief.
Quarantine Division: RICHARD W. HICKMAN, chief.
Zoological Division: B. H. RANSOM, chief.
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CONTENTS.

ILLUSTRATIONS.

PLATES.

TEXT FIGURES.

TWENTY-FIFTH ANNUAL REPORT OF THE BUREAU OF ANIMAL INDUSTRY.

REPORT OF THE CHIEF OF THE BUREAU FOR THE FISCAL YEAR ENDED JUNE 30, 1908.

By A. D. MELVIN.

LINES OF WORK.

The work of the Bureau in the interest of the live-stock industry and the public health has continued as heretofore along the following principal lines, all of which are more or less intimately connected:

Meat inspection.

Inspection of animals for export and of vessels carrying them.

Supervision of the interstate transportation of live stock.

Inspection and quarantine of imported animals.

Eradication of the diseases known as scabies of sheep and cattle.

Eradication of southern cattle ticks.

Inspection of southern cattle.

Scientific investigations concerning diseases of animals.

Work in animal husbandry.

Work in the interest of the dairy industry and of wholesome dairy products.

The force of employees has remained practically stationary in number, there being 3,136 on the rolls July 1, 1908, as compared with 3,152 a year before. Of the former number, 2,203 were engaged in meat inspection.

A few of the more important matters with which the Bureau is concerned will be discussed briefly, after which the work of the various divisions will be presented more in detail.

THE MEAT INSPECTION.

The Federal meat inspection has been extended during the year, and it is estimated that it now covers slightly more than one-half of the entire number of animals slaughtered for food in the United States. Details of the year's operations will be found in the portion of this report which deals with the Inspection Division. With two years' experience under the new law the work is better systematized and more uniformly carried on at the various stations. The large

force engaged in this service maintains a high standard of efficiency, and every effort is made to insure the wholesomeness of the inspected product, sanitary conditions of preparation, and honesty of labeling. The new regulations are based on the best and most recent scientific knowledge and judgment, and it is safe to say that no country has a more stringent meat-inspection system or one which better safeguards the health of the consumer of meat products.

One effect of the inspection under the new law has been a marked improvement in the sanitary condition of the abattoirs. In old establishments there have been many improvements, and in the construction of new buildings such materials have been used as would promote sanitation.

Newspaper reports of the finding of preservatives in American meat products abroad make a statement of the facts desirable. The meat-inspection law, after prohibiting the use of dyes, chemicals, preservatives, or ingredients which render the meat or meat food product unsound, unhealthful, unwholesome, or unfit for human food, makes the following exception:

Provided, That, subject to the rules and regulations of the Secretary of Agriculture, the provisions hereof in regard to preservatives shall not apply to meat food products for export to any foreign country and which are prepared or packed according to the specifications or directions of the foreign purchaser, when no substance is used in the preparation or packing thereof in conflict with the laws of the foreign country to which said article is to be exported.

The use of preservatives in inspected meat is not permitted except in strict accordance with the foregoing provision of law. However, when foreign purchasers specify that preservatives shall be used, and when foreign governments do not prohibit the importation of meat food products prepared with preservatives, it seems very inconsistent that complaint should be made when preservatives are found. In some instances, however, when the presence of preservatives has been reported and when investigation has shown that no preservative was really added, it has been determined that the alleged preservative was a natural constituent of normal meat and that the amount found was only the merest trace and no more than frequently occurs naturally.

While the Federal inspection is limited to establishments or persons doing an interstate or export business, the Bureau has opportunities for learning conditions at other places. It should be borne in mind that nearly half of the meat supply of the country does not come under Federal inspection and that only a very small part of this receives an efficient State or municipal inspection. Some of the most insanitary and revolting conditions have been found at small local abattoirs, which are not and can not be reached by the Federal inspection. It is only natural, too, that suspicious and diseased live stock, which might be condemned if sent to an inspected

establishment, finds its way to the uninspected places; and as the Federal law prohibits the interstate shipment of uninspected meat, it follows that the product of the numerous abattoirs which are without Federal inspection is sold and consumed within the States where they are located. Furthermore, this Bureau frequently finds preservatives in meats prepared by local butchers.

There is great need, therefore, for the States and cities to provide an adequate local inspection which will protect their people against these local establishments. Few States have done anything in that direction, and very few cities have an adequate and efficient inspection. In most cities where there is a municipal inspection it consists simply in an examination of the meat as exposed for sale in the markets and stores. Such an inspection is almost worthless. While it may result in the condemnation of a certain amount of unwholesome and tainted meat, the average purchaser is able to detect and avoid such meat for himself. What is required is an inspection that will protect the consumers where they can not protect themselves, namely, by guarding against the meat of diseased animals. This can be done only by having a sufficient number of competent veterinarians to inspect the carcasses at the time of slaughter, and this is a kind of inspection that very few cities have. Without such a local inspection the consumer can be assured of wholesome meat only by purchasing no meat except that bearing the Government inspection label.

PROGRESS IN SUPPRESSING DISEASES OF LIVE STOCK.

Gratifying headway has been made in the work of controlling and eradicating contagious diseases of live stock. Especially is this true with regard to sheep scab. During the fiscal year the quarantine on account of this disease was removed from two States (Idaho and Wyoming), and since the close of that period it has been removed from Kansas, Nebraska, and large parts of North Dakota and South Dakota. In the 12 States and Territories remaining in quarantine such good progress has been made that the amount of infection remaining is very small in all but California. The situation is so encouraging as to lead to the hope that considerable additional territory can be released during the coming year, and that the disease may be entirely wiped out within a few years.

The quarantine on account of cattle mange was removed during the fiscal year from parts of Kansas and Nebraska, and has since been removed from parts of North Dakota, Colorado, Kansas, Oklahoma, and New Mexico. Parts of 10 States and Territories still remain in quarantine.

The work of exterminating the ticks which are such a detriment to the cattle industry of the South has been continued vigorously and

with good results. During less than three years of this work nearly 64,000 square miles of territory have been freed from these troublesome parasites. This is an area somewhat larger than that of the State of Georgia. This gives assurance of ultimate success, although many years will probably be required for the completion of the work. Much depends upon the amounts appropriated for this work by the States, as well as by the Federal Government, but more upon the assistance and cooperation of the cattle owners themselves, for without a fair degree of cooperation the eradication of the tick can never be accomplished.

HOG-CHOLERA VACCINE.

The vaccine or serum for the prevention of hog cholera, prepared according to methods worked out under the direction of Dr. M. Dorset, chief of the Biochemic Division, as described in previous reports, has been further tested in a practical way during the year and its efficacy has been still further confirmed.

In order to make this treatment available for general use, it is necessary that some arrangements should be made for supplying the vaccine to hog raisers. To prepare vaccine for the entire country, however, would be such a great undertaking that the Bureau does not feel warranted in attempting it. It is believed that the best way of accomplishing this object would be for the various States to prepare the serum and furnish it to citizens on such terms as may be thought proper. With this object in view, the Department invited a number of experiment station and State veterinarians to visit the Bureau's experimental farm near Ames, Iowa, so as to observe the method of preparing and applying the vaccine. At these conferences the opinion was generally expressed that the vaccine can be successfully used in the prevention and control of hog cholera; also that it was advisable for the States to make ample provisions for this very important work. In most States separate appropriation should be made for providing suitable laboratories and farms where the serum can be prepared by competent assistants under the supervision of the live-stock sanitary board or State veterinarian. Some of the State experiment stations have successfully undertaken to prepare and distribute the vaccine, and it is hoped that others will do likewise.

THE TUBERCULOSIS PROBLEM.

The most serious problem now confronting the live-stock industry is tuberculosis. This disease has progressed to an alarming extent and is undoubtedly on the increase, especially in States where no adequate measures have been taken against it. The recent agitation in favor of a more wholesome food supply has drawn attention to tuberculosis not only as it relates to the health of the consumer of

meat and dairy products, but as it affects the business of raising live stock in an economic way. Judging from the meat-inspection statistics and from records of the tuberculin test, it is estimated that more than 1 per cent of the beef cattle, 10 per cent of the dairy cattle, and 2 per cent of the hogs in the United States are affected with tuberculosis. The financial loss that is chargeable to this disease among farm animals amounts to no less than $23,000,000 annually. Both in the interest of the public health and for the financial benefit of stock raisers, it is time that more aggressive and systematic measures were taken to suppress and eradicate this disease.

During the past year the Bureau has been endeavoring, in cooperation with the authorities of Nebraska and Wisconsin, to trace the origin of animals found affected with tuberculosis in the meat inspection. The results of this work have been very satisfactory in the way of enabling the State authorities to locate and stamp out centers of infection. In Nebraska, for instance, in every case where diseased animals have been found in the meat inspection and their origin traced back to the farm, tuberculosis has been found among the live stock remaining on the farm. It is therefore evident that the meat inspection can be made an effective agency for discovering and locating the presence of disease, and it seems important that the meat inspection should continue to be intimately connected with the administration of any work for the eradication of tuberculosis as well as other contagious diseases of live stock.

In order to give general application to this plan of tracing the disease, it seems essential that the various States should empower their officials by law to require that shippers shall tag their live stock, especially cows, shipped for slaughter, in such a way that they may be identified and their origin determined.

The agricultural appropriation act for the fiscal year 1909 authorizes the Secretary of Agriculture "to investigate the prevalence and extent of tuberculosis among dairy cattle in the United States," and under this authority steps are being taken to collect such information. This should be followed, however, by systematic work on a large scale by the Federal and State authorities in cooperation, with a view to the ultimate eradication of tuberculosis from farm animals. This work to be successful will require many years and considerable expenditures, but there is no doubt that such expenditures will be a profitable investment, even if the subject is considered wholly from the financial standpoint. After more specific information is obtained as to the extent of the infection and as to the localities in which it prevails, the tuberculin test should be applied generally and systematically in the infected sections, this test being unquestionably the most accurate method of diagnosis known. The safest way of disposing of diseased animals is to slaughter them, but in order to make

the financial loss as light as possible it would be well to have such animals slaughtered at abattoirs having Federal or other competent veterinary inspection. In this way a large proportion may be safely passed for food and made to yield their full meat value, while only those whose meat may be dangerous to health will be condemned. It seems only reasonable that persons whose animals are condemned and slaughtered should be paid indemnity, at least in part.

An important step looking toward the suppression of tuberculosis in live stock was taken in the organization in New York City in March of an association of live-stock sanitary officers of the States of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania, and New Jersey, with the special object of regulating and controlling the movement between those States of dairy and breeding cattle.

INADEQUACY OF STATE LAWS FOR DEALING WITH CONTAGIOUS DISEASES OF ANIMALS.

Much of the Bureau's work for the control and eradication of contagious disease of live stock has been done in cooperation with State officers. In a few States the authorities are provided with both laws and funds for such work, but in a large majority of the States this is not the case. The Bureau has recently collected the laws of various States bearing on this subject, and it is found that in most of the States the laws are very inadequate for the protection of live stock against contagious diseases and that in most cases the appropriations are entirely insufficient for effective work. While many of the States have cooperated very effectively with the Federal Government in the eradication of sheep scabies, cattle mange, and the southern cattle tick, the lack of ability on the part of other States to do their share in such work has resulted in delaying its progress. It is very important for the success of such work, especially with regard to the cattle tick and tuberculosis, that the States concerned should enact laws giving adequate powers to their officers and should make sufficient appropriations for the work that is to be done. In work of this kind it seems reasonable and proper that the expense should be divided equally between the States and the General Government.

RANGE CONDITIONS IN THE WEST.

Much of the Bureau's field work is done in the range country of the West, and good opportunities are afforded for studying conditions in that section as they affect the live-stock industry. The conditions on the open range are unsatisfactory from the standpoint of both the stock owners, who desire to use it for grazing purposes, and the sanitary officers, who are combating contagious diseases of live stock. It is well known that, aside from the reduction of the area of public

range as a result of the taking up of homesteads, the grass on the remaining range has been so depleted that the number of animals which can be supported on a given area is much less than formerly. This condition is due to overstocking and misuse of the range. The range has been overcrowded, especially at certain seasons and in the vicinity of watering places, and the close grazing and tramping have in some places almost exterminated the native grass. It has also been found very difficult to eradicate or even to prevent the spread of contagious diseases of live stock on the open range, because the lack of fences or inclosures makes it practically impossible to control the movement of animals. This is especially true in the case of cattle mange, and if some more destructive disease should gain a foothold under such conditions it would undoubtedly cause enormous loss.

The best remedy for both of these conditions, in my opinion, would be the passage by Congress of a law regulating grazing and providing for the leasing of public range. By this means the range would be brought under definite proprietorship, and the lessees could exercise control over the land and would be encouraged to make improvements which would aid in conserving both the live stock and the range. Under such circumstances the enforcement of quarantine measures would be much easier.

ADDITIONAL AUTHORITY NEEDED FOR DEALING WITH CONTAGIOUS DISEASES.

Under existing legislation the Secretary of Agriculture has power to enforce measures for the protection of the live stock of the United States against the introduction of contagious diseases from abroad so far as they are liable to be brought in with imported animals or with hay, straw, forage, or similar material, or meats, hides, or other animal products from infected countries. There still remains, however, the danger that the contagion of some destructive animal disease may be introduced by the importation of virus or cultures of organisms causing such diseases. It is therefore respectfully recommended that Congress enact a law prohibiting the importation, except with permission of the Secretary of Agriculture, of any virus that may be infectious for domestic animals. It is not the intention to prevent absolutely the importation of virus and cultures from abroad or to interfere with any proper scientific investigations by responsible persons, but it is considered desirable to have all such importations subject to the control and approval of the Secretary of Agriculture in order to avoid the introduction and spread of contagious diseases by careless investigators.

Authority should also be given to build fences along the international boundary lines, in order to control the movement of live stock and prevent the introduction of contagion.

As further measures to prevent the spread of contagious diseases of animals, the Secretary of Agriculture should have power to require the cleaning and disinfection of cars carrying interstate shipments of live stock, at such times and places as he may deem necessary; also to require that stock yards handling live stock which is the subject of interstate transportation shall be equipped and maintained in such manner as he may consider necessary in order to facilitate disinfection.

MORE LAND NEEDED FOR EXPERIMENT STATION.

The Bureau Experiment Station at Bethesda, Md., greatly needs more land in order to carry on properly experimental work with animal diseases and in breeding small animals, feeding poultry, etc. A tract of about 60 acres adjoining the land owned by the station has been leased so as to obtain more ground, but this arrangement is unsatisfactory, as the termination of the lease by the owners would cause serious injury to work under way, and might even force the abandonment of unfinished investigations. It is highly desirable that the station should be provided with sufficient land owned by the Government, and I respectfully recommend that Congress be asked to appropriate the necessary sum for the purchase of acreage at least equal to that now leased.

PUBLICATIONS.

There has been an unusual demand for the publications of the Bureau, especially those relating to tuberculosis and sanitary milk production. During the fiscal year there were issued by the Bureau 79 new publications, aggregating 2,446 printed pages, and besides these there were numerous reprints of former publications. The new publications consisted of the Twenty-third Annual Report of the Bureau (for 1906), a revised edition of the Special Report on Diseases of the Horse, the annual report of the Chief of the Bureau for the previous fiscal year, 9 bulletins, 23 circulars, 25 orders and regulations, 2 Yearbook articles, and 17 miscellaneous publications. The Special Report on Diseases of the Horse has proved to be one of the most popular publications ever issued by the Government, the total number of copies printed up to date amounting to almost 1,000,000. A monthly publication, issued under the name of "Service Announcements," has been found exceedingly useful in disseminating information and instructions to the large force of employees, especially in the meat-inspection service. In addition to the publications issued during the fiscal year, the Twenty-fourth Annual Report of the Bureau (for 1907) was prepared for publication. These annual reports are volumes of several hundred pages, and contain special articles of both a popular and a scientific nature, in addition to mis-

cellaneous information relating to the live-stock industry and the work of the Bureau.

THE INSPECTION DIVISION.

The work of the Inspection Division, in charge of Dr. R. P. Steddom, chief, consists, as heretofore, of two main lines: (1) the meat inspection and (2) most of the field work for the control and eradication of contagious diseases of animals. The latter comprises the inspection of southern cattle and the supervision of their movement when forwarded from the area quarantined on account of Texas or tick fever, the work for the extermination of the southern cattle tick which spreads this disease, and the work for the eradication of scabies of sheep and cattle in the West.

THE MEAT INSPECTION.

In the report for the fiscal year 1907 some of the tabular information covered only the nine months in which the new law had been in operation, while by consolidating the figures representing the work done under the old and new laws some tables were made to cover the entire year. The present report, therefore, is the first to cover an entire fiscal year's operations under the meat-inspection law of June 30, 1906, which became effective October 1, 1906.

NEW REGULATIONS.

The meat-inspection regulations promulgated July 25, 1906, and issued as B. A. I. Order 137, and the ten amendments thereto, were revised and republished as B. A. I. Order 150, effective April 1, 1908. The regulations are based upon the experience of more than a year and a half under the operation of the new law, and not only embody the judgment of the experts of the Department of Agriculture, but in their preparation the recommendations of a committee of outside scientists appointed by the Secretary have been adopted to a great extent. The more important features of the revised regulations are those—

(*a*) Imposing inspection upon branch houses of establishments having inspection if such branch houses engage in interstate or foreign commerce and slaughter animals or "process" meat.

(*b*) Prescribing the domestic meat label to be furnished by the establishment for use on interstate shipments of meat or meat food products in lieu of the regular white meat-inspection stamp previously furnished by the Bureau.

(*c*) Requiring the separation on or before October 1, 1908, of compartments in which edible products are prepared or handled from those in which inedible products are prepared or handled for industrial uses.

(*d*) Authorizing inspectors in charge to permit the return to official establishments, subject to reinspection, of inspected and passed products which are alleged to have become unsound.

ESTABLISHMENTS AND CITIES.

The records show that during the year inspection has been conducted at 787 establishments in 211 cities and towns, a gain of 79 establishments and 25 cities and towns as compared with the previous fiscal year. Inspection was withdrawn during the year from 95 establishments. Of this number, 77 either discontinued slaughtering or so altered their business that Federal inspection was not required, 1 manufactures products for medical use only, 1 manufactures only inedible fats, 2 were given market inspection, 2 transferred their business to other establishments, 3 violated the regulations by adulterating lard with tallow and low-grade fat, 1 was given exemption, 3 failed financially, 4 were insanitary, and 1 displayed a misleading sign.

Below are shown the number of establishments and the number of cities and towns where inspection of meat and meat food products was conducted in each fiscal year since 1891.

Number of establishments and cities where meat inspection has been conducted, fiscal years 1891 to 1908.

Year.	Establishments.	Cities and towns.	Year.	Establishments.	Cities and towns.
1891	9	6	1900	149	46
1892	23	12	1901	157	52
1893	37	16	1902	155	50
1894	46	17	1903	156	50
1895	55	19	1904	152	51
1896	102	26	1905	151	52
1897	128	33	1906	163	58
1898	135	35	1907	708	186
1899	139	42	1908	787	211

MARKET INSPECTION.

During the fiscal year market inspection has been granted to 4 more cities, thus making 33 cities that now have the privilege of forwarding from public markets, upon reinspection and under marks of Federal inspection, interstate shipments of inspected and passed meat or meat food product which, in being prepared for delivery to the customer, becomes separated from the original mark of Federal inspection.

EXEMPTION FROM INSPECTION.

During the year about 116,000 shipments were made under certificates of exemption as provided by law. The total weight of these shipments can not be determined, as in many instances the weight has not been included in the shipper's certificate. However, a determined

effort is now being made to have the weight of every shipment reported, so that hereafter an accurate record of this traffic may be kept.

The number of certificates of exemption outstanding June 30, 1908, was 2,477, as against about 4,000 at the end of the previous fiscal year. In accounting for the reduced number it may be said that in some instances exemption has been superseded by inspection, while in others the certificates have been recalled on account of poor sanitation, violation of the regulations, etc.; however, the great majority of previous holders of certificates are permitted under the law to ship as farmers, and hence need no certificate of exemption. Certificates are required for retail butchers and retail dealers.

ANTE-MORTEM INSPECTION.

The number of ante-mortem inspections made of animals for slaughter is shown in the following table, and indicates an increase of 6 per cent over the previous fiscal year:

Ante-mortem inspections of animals about to be slaughtered, fiscal year 1908.

Kind of animals.	Passed.	Suspected.[a]	Total.
Cattle	7,198,224	32,048	7,230,272
Calves	1,993,461	2,134	1,995,595
Sheep	9,778,189	1,751	9,779,940
Swine	34,980,571	27,456	35,008,027
Goats	46,066	1	46,067
Total	53,996,511	63,390	54,059,901

[a] This term is used to designate animals found diseased or suspected of being unfit for food on ante-mortem inspection, most of which are afterwards slaughtered under special supervision, the final disposition being determined on post-mortem inspection.

POST-MORTEM INSPECTION.

The following table shows the number of inspections made at time of slaughter, an increase of 5.96 per cent over the previous fiscal year:

Post-mortem inspections, fiscal year 1908.

Kind of animals.	Passed for food.	Passed for lard and tallow only.	Condemned.	Total.
Cattle	7,081,315	1,744	33,216	7,116,275
Calves	1,989,629	4	5,854	1,995,487
Sheep	9,694,359	96	8,090	9,702,545
Swine	34,878,469	106,675	127,933	35,113,077
Goats	45,920	....	33	45,953
Total	53,689,692	108,519	175,126	53,973,337

Included in the foregoing table are the post-mortem inspections of animals rejected or suspected on ante-mortem inspection, and the final

inspection of carcasses that were retained[a] for disease or other cause at time of slaughter.

The various diseases and conditions for which fresh carcasses and parts were condemned and tanked are shown in the following table:

Diseases and conditions for which condemnations were made on post-mortem inspection, fiscal year 1908.

Cause of condemnation.	Cattle.		Calves.		Sheep.		Swine.		Goats.	
	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.	Carcasses.	Parts.
Tuberculosis	24,371	27,467	159	91	8	1	77,584	628,462	......	......
Actinomycosis	667	32,430	3	26	......	......	......	......	......	......
Hog cholera and swine plague	......	......	......	......	......	......	27,234	......	......	......
Septicemia, pyemia, and uremia	1,015	......	302	......	588	......	7,076	......	3	......
Pneumonia, pleurisy, enteritis, hepatitis, nephritis, metritis, etc	1,506	......	267	......	1,100	......	6,846	......	1	......
Icterus	125	......	183	......	869	......	1,784	......	9	......
Texas fever	373	......	663	......	......	......	......	......	......	......
Caseous lymphadenitis	......	......	......	......	1,034	2	......	......	5	......
Tumors and abscesses	116	4,357	46	18	105	27	1,280	1,544	......	......
Pregnancy and recent parturition	208	......	......	......	100	......	235	......	......	......
Injuries, bruises, etc	1,856	1,891	315	217	647	138	354	3,332	3	1
Immaturity	......	......	3,097	......	......	......	......	......	......	......
Sexual odor	......	......	......	......	......	......	1,186	......	......	......
Miscellaneous	2,979	1,337	819	44	3,639	30	4,354	3,251	12	......
Total	33,216	67,482	5,854	396	8,090	198	127,933	636,589	33	1

SUPERVISING PREPARATION OF MEATS AND PRODUCTS.

The amount of meat food product prepared and processed under Bureau supervision is shown in the following table:

Meat and meat food products prepared and "processed" under Bureau supervision, fiscal year 1908.

Kind of product.	Weight.	Kind of product.	Weight.
	Pounds.		*Pounds.*
Beef placed in cure	177,555,376	Lard substitute	408,666,880
Pork placed in cure	2,875,997,349	Oleo stock and edible tallow	56,136,236
All other classes placed in cure	6,260,940	Oleo oil	163,289,340
Sausage chopped	416,199,855	Lard stearin	11,805,632
Canned beef	62,396,382	Oleostearin	73,999,893
Canned pork	27,392,485	Oleomargarin and butterine	79,380,283
All other canned meats	2,792,935	Miscellaneous products	134,150,192
Beef extract	715,829		
Lard	1,433,777,993	Total	5,958,298,364
Lard compound	27,780,764		

The following amounts of meat and meat food products were condemned on reinspection during the fiscal year: Beef, 31,653,279 pounds; pork, 11,504,400 pounds; mutton, 128,230 pounds; veal,

[a] This term is applied to carcasses held on suspicion on first post-mortem examination, to be subjected later to more thorough examination for determining final disposition.

58,239 pounds; goat meat, 58 pounds; total, 43,344,206 pounds. The principal causes for condemnation were that the meat or product was found to be sour, tainted, putrid, unclean, or, in the case of fats, rancid. The foregoing figures show an average monthly increase over the condemnations on reinspection during the first nine months under the new law of about 118 per cent.

INTERCHANGE OF MEATS BETWEEN OFFICIAL ESTABLISHMENTS.

During the year the following amounts of inspected and passed meat and meat food products were, upon identification as "U. S. inspected and passed" by Bureau employees, admitted to official establishments: Beef, 794,496,355 pounds; veal, 23,055,853 pounds; mutton, 26,204,576 pounds; goat meat, 26,334 pounds; pork, 1,668,782,221 pounds; total, 2,512,565,339 pounds.

MEATS AND PRODUCTS CERTIFIED FOR EXPORT.

The amount of meat and meat food products certified by the Bureau for export shows an increase of 13.8 per cent over the previous fiscal year. The following table shows the classification:

Inspection certificates issued for export of meat and meat food products, fiscal year 1908.

Kind.	Number.	Beef.	Mutton.	Pork.	Total.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
Regular	75,983	424,914,258	4,089,021	737,807,291	1,166,810,570
Preservative	46,312	5,852,094	35,460	373,063,684	378,951,238
Total	122,295	430,766,352	4,124,481	1,110,870,975	1,545,761,808

There were also issued 2,626 "animal-product" certificates, covering the exportation of 26,007,484 pounds of such inedible products as hoofs, horns, casings, bladders, bungs, etc.

CONTROL OF CONTAGIOUS DISEASES.

TEXAS FEVER.

The regulations to prevent the spread of splenetic fever in cattle were amended in March, 1908, by amendment 3 to B. A. I. Order 143, effective April 1. In this amendment the specifications for quarantine yards at points outside the quarantined area, and for native yards at points within the quarantined area, were amplified with a view to further eliminating the danger of spreading the Texas fever tick. The live-stock inspector detailed to the inspection of the facilities of stock-yard and transportation companies for handling southern cattle at points outside the quarantined area is still pursuing that work, and

much has been accomplished in the way of bringing these facilities up to the standard required by the regulations. It is but proper to state that almost without exception the necessary alterations or improvements have been cheerfully made. An effort is also being made to enforce a more strict compliance with the regulations governing the disinfection of infected cars, and to this end transportation companies are being required, whenever practicable, to have this work done at the points of unloading, thus reducing to a minimum the number of infected cars that are permitted to be forwarded for cleaning and disinfection at other plants.

The shipments of cattle of the quarantined area to northern markets for immediate slaughter show an increase over the previous quarantine season of 15.65 per cent, the number of head being 1,157,285, contained in 40,262 cars.

There were inspected in the provisionally quarantined area 333,610 head of cattle which were permitted to be shipped to points outside the quarantined area for purposes other than immediate slaughter. These cattle were moved under 3,175 certificates issued by Bureau employees.

During the fiscal year 153,480 head of cattle were dipped in crude petroleum under Bureau supervision, and 39,444 cars that had carried southern cattle were cleaned and disinfected.

THE ERADICATION OF CATTLE TICKS.

The work of eradicating the ticks which spread the contagion of so-called Texas fever of cattle has been continued with good effect, in cooperation with the various States interested. As a result of this work a total area of more than 40,000 square miles, as shown by the following table, was released from quarantine during the fiscal year:

Area released from quarantine as a result of tick eradication, fiscal year 1908.

State.	Square miles.	State.	Square miles.
California	21,136	North Carolina	6,312
Texas	660	Virginia	3,181
Oklahoma	2,612		
Arkansas	3,071	Total	40,798
Tennessee	3,826		

In addition to the States represented in the foregoing list, active operations are being carried on in the States of South Carolina, Georgia, Alabama, Mississippi, Louisiana, and Missouri, and some assistance is still being rendered to the authorities in Kentucky.

During the year 2,271,436 inspections of cattle were made, of which 1,372,648 were reinspections.

SCABIES IN SHEEP.

Amendment 1 to B. A. I. Order 146, effective October 15, 1907, released from quarantine on account of scabies in sheep the States of Idaho and Wyoming, and since the close of the fiscal year an order has been issued releasing the States of Kansas and Nebraska and those portions of North Dakota and South Dakota lying east and north of the Missouri River. The whole number of inspections made during the fiscal year was 59,471,141, a decrease, as compared with the previous year, of 5.3 per cent. The whole number of dippings recorded during the fiscal year was 17,589,578, of which 4,881,979 were redippings. The increase in dippings, due to a general dipping in New Mexico during the fall of 1907 and active work in California during the spring and summer of 1908, was 45 per cent as compared with the previous year.

The following table shows the number of inspections and dippings of sheep for scabies and the number of cars cleaned and disinfected on account of this disease since 1900:

Inspections and dippings of sheep for scabies, and cars cleaned and disinfected, fiscal years 1900 to 1908.

Fiscal year.	Inspections.	Dippings.	Cars cleaned and disinfected.
1900	1,801,392	626,838	....
1901	7,912,724	1,034,368	....
1902	11,186,661	1,017,162	791
1903	16,444,370	2,167,002	752
1904	40,967,961	9,578,476	2,732
1905	53,680,786	16,873,659	7,965
1906	59,246,288	12,396,976	8,625
1907	62,625,831	12,133,466	6,275
1908	59,471,141	17,589,578	9,338

SCABIES IN CATTLE.

By amendment 1 to B. A. I. Order 145, effective March 1, 1908, and amendment 2 to the same order, effective May 1, 1908, 4 counties in Kansas and 57 counties in Nebraska were released from quarantine for scabies in cattle, and since the close of the fiscal year an order has been issued releasing the remainder of that portion of North Dakota lying east and north of the Missouri River, and 6 whole counties and portions of 7 other counties in Colorado.

The whole number of inspections made during the fiscal year was 16,920,100, an increase of 11 per cent over the previous year; and the whole number of dippings, 1,527,280—of which 246,278 were redippings—is an increase over the previous year of 227.3 per cent.

The following table shows the inspections and dippings of cattle for scabies, and cars cleaned and disinfected on account of that disease since 1904:

Inspections and dippings of cattle for scabies, and cars cleaned and disinfected, fiscal years 1904 to 1908.

Fiscal year.	Inspections.	Dippings.	Cars cleaned and disinfected.
1904	1,124,321	162,554	532
1905	14,085,267	563,394	29,897
1906	14,983,260	243,826	19,992
1907	15,243,323	466,623	15,009
1908	16,920,100	1,527,280	17,601

SCABIES IN HORSES.

The whole number of inspections of horses and mules for scabies was 21,727, and the whole number of dippings or sprayings was 5,593.

THE QUARANTINE DIVISION.

The Quarantine Division, under the direction of Dr. R. W. Hickman, chief, has charge of the work of the Bureau relating to the exportation and importation of live stock, including the management of the quarantine stations at various ports of entry for imported animals, and also conducts certain special investigations.

INSPECTION OF VESSELS AND EXPORT ANIMALS.

During the fiscal year 638 inspections of vessels carrying live stock were made before clearance, in order to see that the regulations were complied with as to fittings, equipment, ventilation, feed, water, attendants, etc., and 1,093 certificates of inspection were issued for American cattle. The following table gives statistics of inspection of live animals for export during the year:

Number of inspections of American and Canadian animals for export, number rejected, and number exported, fiscal year 1908.

Kind of animals.	American.			Canadian.		
	Number of inspections.	Number rejected.	Number exported.	Number inspected.	Number rejected.	Number exported.
Cattle	570,527	496	301,209	34,743	19	34,724
Sheep	82,579	12	41,438	30,477	8	30,469
Swine	663		663			
Goats	79		79			
Horses	1,109	1	1,332	6		6
Mules	591		591			
Asses	8		8			
Total	655,556	509	345,320	65,226	27	65,199

Most of the animals included in the foregoing statement were shipped to Great Britain. There went to that country, of the American animals, 293,107 cattle, 40,071 sheep, and 963 horses, and of the Canadian animals 34,045 cattle and 30,079 sheep.

The inspection of vessels carrying export cattle and the enforcement of the regulations referred to continue to result in an exceedingly low percentage of losses of animals in transit. Statistics of animals landed at three principal British ports show that only 0.17 per cent of the cattle, 0.22 per cent of the horses, and 0.95 per cent of the sheep were lost at sea.

During the fiscal year there were inspected for export to Canada 34,835 sheep, 1,779 horses, 487 cattle, and 7 hogs. Of these horses, 1,726 were tested with mallein for glanders, of which number 7 reacted and were excluded from exportation. Of the cattle, 319 were tested with tuberculin, of which number 16 failed to pass. During the fiscal year 226 American horses were reported as inspected and subjected to the mallein test by Canadian official veterinarians at the border, and of this number 89 reacted and were rejected.

INSPECTION AND QUARANTINE OF IMPORTED ANIMALS.

In order to protect the live stock of the United States from contagion that is liable to be introduced with animals from other countries, the regulations require that all horses, cattle, sheep, and other ruminants and swine imported into the United States must be inspected before they are admitted, and, in addition, that all ruminants and swine from any part of the world except North America shall be quarantined. For the importation of animals for which quarantine is required, a permit (in duplicate) must be procured from the Secretary of Agriculture prior to shipment. Importations are not permitted at all from some parts of the world where destructive diseases of animals prevail.

The following tables show the number of imported animals inspected and quarantined and the number inspected but not quarantined during the fiscal year:

Number of imported animals inspected and quarantined, fiscal year 1908.

Ports of entry.	Cattle.	Sheep.	Swine.	Goats.	Other animals.
New York	604	268	42	3	115
Boston	43	7	5	1	
Baltimore		113			
Canadian border ports	162	102	29		
Total	809	490	76	4	115

Number of imported animals inspected but not quarantined, fiscal year 1908.

Ports of entry.	Cattle.	Sheep.	Swine.	Horses.	Mules and asses.	Goats.	Other animals.
New York				2,901	168		7
Boston		2		153	1		
Philadelphia				7			
Baltimore				104			
New Orleans				54			
San Francisco					1		
Portland, Me				43			2
Mexican border ports	65,485	41,565	380	1,016	1,205	748	23
Canadian border ports	15,951	115,655	534	3,341	12	5	33
Total	81,436	157,222	914	7,619	1,387	753	65

TUBERCULIN TEST IN GREAT BRITAIN.

The regulations governing the importation of animals subject to inspection and quarantine provide that all cattle six months old or over imported from Great Britain, Ireland, and the Channel Islands shall be tested with tuberculin by an inspector of the Bureau of Animal Industry before being exported or after arrival at the animal quarantine station at the port of entry. The following table shows the results of such tests made in Great Britain during the fiscal year:

Results of tuberculin tests in Great Britain of cattle for importation, fiscal year 1908.

Breed.	Passed.	Rejected.
Shorthorn	1	
Jersey	357	4
Ayrshire	42	8
Guernsey	144	1
Galloway	11	
Total	555	13

CONTROL AND TREATMENT OF ANIMAL DISEASES.

To the Quarantine Division there is assigned a large amount of correspondence requesting information and asking for aid in combating animal diseases. Material assistance is rendered to State live-stock sanitary boards and other officials in enabling them to locate and take proper procedure for the control of contagious diseases of animals in their States, and, as far as practicable, cooperative assistance is given to the State officers in the suppression of such outbreaks. Farmers and breeders of animals are advised in the case of noncontagious diseases of the most approved and simple measures for their prevention and cure.

TUBERCULIN TESTING OF CATTLE IN THE DISTRICT OF COLUMBIA AND VICINITY.

The work of applying the tuberculin test to dairy cattle in the District of Columbia and vicinity was started in the spring of 1907, under the direction of the Pathological Division, but was later transferred to the Quarantine Division. The principal object has been to assist the Health Department of the District of Columbia in its efforts to create a milk supply free from the contamination of the germs of tuberculosis. The test is applied without charge and upon the voluntary request of the owner of the cattle, provided that he sign a form of agreement with the Bureau. A steadily increasing number of dairymen have availed themselves of this opportunity of proving the health of their herds or of detecting and removing tuberculous animals. The following public institutions in the District of Columbia, which includes all such institutions maintaining their own herds of dairy cattle, have had the tuberculin test applied to their cattle, by which it was shown that four of these herds were in a satisfactory state of health at the time of applying the first test: The United States Soldiers' Home, the Government Hospital for the Insane, the Girls' Reform School, the Home for the Aged and Infirm, the National Training School for Boys, the Washington Asylum, and the Columbia Institution for the Deaf and Dumb. The test was also applied to the herd supplying milk to the United States Naval Academy at Annapolis, Md.

From the beginning of the work in the spring of 1907 up to the close of the fiscal year, June 30, 1908, the Bureau applied the tuberculin test to 2,468 cattle in the District of Columbia, Maryland, and Virginia, of which 387, or 15.68 per cent, reacted. Of the reacting animals, 126 were slaughtered under the Bureau's inspection, and in all but a single case the presence of tuberculosis was demonstrated on post-mortem examination. The diagnosis of the tuberculin test was therefore confirmed in 99.21 per cent of the animals slaughtered. Of the 126 animals killed under inspection, 94 were so very slightly affected as to be safely passed for food after removal of the glands or organs in which the lesions were found, while 32 were condemned.

Much of the growth of interest in the tuberculin test among cattle owners is probably attributable to the fact that instead of forcing the test upon them an educational policy has been pursued with a view to leading them to an appreciation of the significance of the dangers of tuberculosis among their cattle, and thus to a recognition of the economic importance of obtaining sound animals and the production of a wholesome milk supply. Another factor in the growth of this

interest has been the demonstration of the accuracy of the tuberculin test when applied by the veterinary inspectors of this Bureau.

The form of agreement adopted for use in the tuberculin testing of cattle is set forth below. This is intended to represent the most liberal measures for the control of tuberculosis that are compatible with economic principles, aiming at the final eradication of the disease and the maintenance of a herd free from tuberculosis.

UNITED STATES DEPARTMENT OF AGRICULTURE.

BUREAU OF ANIMAL INDUSTRY.

Agreement.

In consideration of the testing of my herd of cattle by the Bureau of Animal Industry of the United States Department of Agriculture, and the assistance of said Bureau in enabling me to produce and maintain a herd of cattle free from the contamination of tuberculosis, I, ----------------------------------,
(Name of owner.)
of --------------------------------, owner of said herd of cattle, comprising
(Post-office address.)
---, do hereby
Number and kinds over 6 months old; number and kinds under 6 months old.)
agree as follows:

1. I will cause all animals which react to the tuberculin test, and which also show other marked symptoms of tuberculosis, to be slaughtered within a reasonable time under the United States meat-inspection regulations, and I will cause the carcasses of said animals to be disposed of according to the meat-inspection regulations of the Bureau of Animal Industry, based upon the lesions found upon inspection.

2. I will cause all animals which react to the tuberculin test, but which show no other evidence of tuberculosis, either to be slaughtered and disposed of as herein provided for animals which show also other evidence of tuberculosis, or I will cause such animals to be removed from the herd and portion of the farm upon which the healthy animals of the herd are maintained, and I will cause the diseased animals to be segregated from the healthy animals, and thereafter they shall remain so segregated.

3. In all cases where the milk from such segregated reacting cows is to be used for any purpose whatever I will cause the said milk to be sterilized.

4. Segregated reacting bulls may be used for breeding, provided they are held on leash and are not permitted to leave the premises reserved for their use, and provided the healthy cows bred to such bulls are not unduly exposed to infected premises or to other diseased cattle.

5. I will cause the young from segregated reacting animals to be removed from their mothers at birth and will not permit the said young to suck their mothers.

6. Any part of my premises contaminated by reacting animals will be submitted by me to a thorough disinfection under the direction or supervision of the Bureau of Animal Industry.

7. All cattle owned by me, both healthy and tuberculous, I will mark, or allow to be marked, in such manner as to enable their identity to be retained, and I will not change the location of or slaughter any tuberculous cattle except after due and timely notification to the Bureau of Animal Industry, stating the exact nature of the change of location, or the exact date, name, and address

of the official establishment at which the animal or animals are to be slaughtered.

8. I will add no cattle to the said herd which have not passed a tuberculin test administered by an authorized public agent qualified to perform such test or by an inspector of the Bureau of Animal Industry.

9. I will comply with all reasonable sanitary measures which are indicated by the proper officials of the State or Territory wherein my herd is located, or by the local board of health under whose permit I am disposing of dairy products, or by the Bureau of Animal Industry.

In witness whereof I have signed this agreement this ______________ day of ____________, one thousand nine hundred and______.

____
Owner of the ______ herd.
(Address) ____________________
____

Witness:
____

VENEREAL DISEASE OF HORSES.

Notwithstanding the fact that the eradication of the disease of horses known as maladie du coït or dourine was believed to have been successfully accomplished a year or two ago, it has been considered wise to continue the inspection of horses in certain Western States where the disease formerly prevailed, to make sure that none of the contagion persisted. During the fiscal year the Bureau veterinarians made 2,884 inspections without discovering any case of the disease.

EXPERIMENT IN EFFECT OF SANITARY CONDITIONS ON TUBERCULOSIS.

In the latter part of the fiscal year a cooperative experiment was instituted with the Virginia Agricultural Experiment Station to determine the variation in the curative influence of fresh air and sanitation upon tuberculous cows kept under different conditions. Twenty tuberculous animals have been entered in the experiment, and these have been divided into three groups, two of which are being maintained under ideal sanitary conditions in new buildings constructed on economic principles, which can be used as models for the farmers. The remaining group, used as a check upon the other two, is kept in a poorly ventilated, insanitary barn, such as is seen upon some farms.

LIVE-STOCK DISEASES AND CONDITIONS IN PORTO RICO.

From August 8, 1907, until April 15, 1908, investigations of the diseases of live stock and conditions surrounding the live-stock industry were carried on in Porto Rico by Dr. William Thompson under the direction of the Quarantine Division.

The Porto Rican cattle are noted throughout the West Indies for their superior size and working ability. A majority of them show

the effect of a cross with zebu blood, which resulted from the importation of a number of zebu bulls in 1858. This cross has lessened the milk yield, but has created an ox with a particularly strong neck and heavy frontal bones and horns, which are particularly valuable when the Spanish yoke is used. This yoke is placed across the forehead and lashed to the horns so that the animal is compelled to push its load rather than draw it. The zebu strain is also characterized by short hair, heavy dewlap, dependent sheath, and an attenuated, whip-like tail.

From 1901 to 1906 the exportation of Porto Rican cattle to other parts of the West Indies was quite extensive, there being exported during this period 65,915 cattle, which went principally to Cuba. On account of the free trade with the United States, the sugar crop has replaced cattle as a source of revenue to the natives, and as a consequence the cattle exports have now practically ceased.

The cattle all over the island of Porto Rico are infested with ticks, although the native cattle of the hill country carry a heavier infestation than those of the lowlands. The lowlands cattle show more conspicuously the effects of the zebu cross, and it is thought that these animals carry fewer ticks, because their short hair does not afford shelter for the development of the female ticks, but exposes them to the action of the tropical sun. Among the hills cattle deaths are recorded, resulting gradually from their heavy infestation with ticks.

United States cattle from Florida and points below the southern cattle fever quarantine line have been imported into Porto Rico without any apparent effect on the health of the native cattle or themselves, but cattle imported from the northern portion of the United States have died to the extent of 60 to 75 per cent. Owing to the warmth of the climate of Porto Rico, the ticks exist on the cattle throughout the entire year.

Blackleg is the all-prevailing disease of Porto Rican cattle. The Bureau vaccine has been introduced and is gradually growing in favor among the natives. Anthrax has been reported from some sections, but its existence in Porto Rico has never been proven.

The island is particularly fortunate in the fact that a diagnosis of tuberculosis has never been confirmed among the native cattle. Their greatest danger from this source would seem to lie in the possible importation of this disease with dairy stock from the United States.

Mange or scabies does not exist among either the horses or the cattle. Glanders and epizootic lymphangitis are quite prevalent among the horses and ponies of the island.

At the present time Porto Rico supplies its own needs for both food and work animals, and is neither importing nor exporting to an appreciable extent.

THE PATHOLOGICAL DIVISION.

Investigations in this Division have been continued under the direction of Dr. John R. Mohler, chief, and while its regular work in relation to rabies, blackleg, tuberculosis, glanders, and the examination of the carcasses of wild animals that have died at the National Zoological Park has been carried on as in former years, there has been much time devoted to matters which are not of a routine or customary nature.

SWAMP FEVER IN HORSES.

In cooperation with the Minnesota Experiment Station the investigations into this disease have been continued. Work has also been done at and near San Antonio, Tex., as the infection has proven as disastrous in those southern latitudes as it has in the colder climates of Minnesota and the Dakotas.

The facts relative to the transmission of the infection, which were mentioned in the report of 1907, have been fully substantiated by the investigations of the past season. Furthermore, it has been proved that guinea pigs, rabbits, dogs, and cattle are immune to the disease. Experiments are now under way to determine the infectiousness of the urine and feces, the vitality of the virus, its transmission by feeding as well as by intermediate hosts, and the changes to be found in the blood and urine of infected horses.

Enlarged quarters have been recently acquired, which will permit the study of a greater number of affected animals, and the work can therefore be pushed to better advantage than under the less favorable conditions of the past.

GLANDERS.

The appearance of cases of glanders with considerable regularity among the horses and mules of the District of Columbia and vicinity serves to prove that the disease is well established in this region and that constant care will be necessary to hold it in subjection. The agglutination method of diagnosis has been used repeatedly during the year and with an increasing degree of satisfaction. Familiarity with its use will no doubt make it a valuable agent in the detection and eradication of glanders.

EPIZOOTIC LYMPHANGITIS.

This is a chronic contagious disease, caused by a specific organism, the *Saccharomyces farciminosus*, and is characterized by a suppurative inflammation of the subcutaneous lymph vessels and the neighboring lymph glands. The disease was first described by Italian and French veterinarians, and the specific organism was discovered by

Rivolta in 1873. The presence of the disease in the United States was first observed by Pearson in 1907, although it is probable that it has existed in various parts of the country for many years. Its presence has also been established in Ohio, Iowa, North Dakota, and California, as well as in our island possessions (the Philippines, Porto Rico, and Hawaii).

CHRONIC BACTERIAL DYSENTERY OF CATTLE.

In March and April there were received at the pathological laboratory the large intestines of several cows which had died of a peculiar disease. These specimens showed thickening and corrugation of mucous membrane, with a few scattered hemorrhagic areas. Stained smears made from all these cases showed the presence of acid-fast bacteria, thicker and shorter than the avian tubercle bacillus, which fact, together with the history and symptoms of the affection, caused the diagnosis of chronic bacterial dysentery to be made. The disease is characterized by a chronic and progressive diarrhea, loss of appetite in the later stages of the disease, and marked emaciation, with anemia. This disease has only recently been recognized in this country, although there is no doubt that it prevails extensively. The course of the malady covers a period varying from two months to two years, according to the severity of each specific case. In 1904 Markus reported this disease in Holland, and subsequently it was observed in Belgium, Switzerland, Denmark, and Great Britain.

TUBERCULOSIS.

The immunizing experiments which this Division had previously inaugurated for the study of protective agencies against tuberculosis in cattle have been continued throughout the year, and a number of animals that had been inoculated with living human tubercle bacilli as a means of protection have since been slaughtered and examined. While many of these cattle have shown great and increased resistance to tuberculosis, no method has yet been found which is reliable enough to justify its general application to the tuberculous herds of the country.

The testing of infected butter has been continued, and in the later experiments of this nature the conclusions reached through former work have been confirmed. Tubercle bacilli will retain their vitality and virulence while in butter under common market conditions for at least five months.

EXHIBIT AT THE INTERNATIONAL TUBERCULOSIS CONGRESS.

During the year a call was sent out to the various cities at which Federal meat inspection is maintained, asking the inspectors to lay

aside the most striking specimens of tuberculosis that they might chance to meet, especially those showing infection of mammary organs either in cattle or swine, later shipping them to the Pathological Division for preservation.

The response to this request was very hearty, and many rare specimens were received. These were properly hardened and then preserved in Kaiserling's fluids, and the choicest were placed in glass containers or mounted in gelatin for exhibition at the International Congress on Tuberculosis or at some later exhibition at which pathological specimens are shown.

TYPHOID BACILLI.

The viability of the typhoid bacillus has been investigated, both in butter and in milk. On the one hundred and fifty-first day after the manufacture of butter from milk infected with typhoid bacilli, living colonies of these bacilli developed on plates that were made from the butter. This proves that typhoid bacilli will retain their vitality under these conditions for one hundred and fifty-one days, and that during this period of time these micro-organisms are ready to multiply whenever placed in suitable environment.

The length of time that typhoid bacilli will remain active in milk under common market conditions far exceeds the length of time that it is ordinarily kept before being put to some domestic use. Examinations at repeated intervals showed that the organisms retained active motility for at least twenty days, whence we must conclude that milk offers an unsurpassed culture medium for the growth of typhoid bacilli, and that when once contaminated such milk continues to offer a menace to the people consuming it.

RABIES.

The Pathological Division has continued to examine all animals brought to the laboratory suspected of having rabies, and all dogs that have bitten anyone and been killed as a consequence. It was found that there had been a decided increase in the prevalence of rabies in the District of Columbia, so much so, in fact, that a muzzling order was issued by the District Commissioners in accordance with law, after the situation had been vigorously presented by the Secretary of Agriculture. A great number of stray dogs found wandering the streets were impounded and destroyed, and this, together with the muzzling order, has probably greatly impeded the spread of the disease. However, the disease is still present and will continue so long as unmuzzled, improperly muzzled, or unrestrained dogs are allowed to run the streets. A comparison of the number

of cases shown in the appended table with the number given in the preceding year's report clearly shows that the disease was not only on the increase, but greatly on the increase, and justifies the enforcement of muzzling in spite of the protests made by some sympathetic owners of dogs who consider only the inconvenience to the dogs while manifesting an utter disregard for the safety of human life in the community. It still seems necessary to impress upon some people that rabies is not a fantasy, but a fact, and this has been brought home to more than one individual during the past year in the most convincing way through being bitten by his own or some vagrant rabid dog.

During the fiscal year ending June 30, 1908, there were examined the brains of 111 dogs, 2 cattle, 1 pig, and 3 cats. Of these, 77 dogs, 1 cow, 1 pig, and 3 cats were found to have been affected with rabies, and 61 of the rabid dogs were furnished by the District of Columbia, being over five times as many as last year. It was found that the most satisfactory method of diagnosis was by demonstrating the presence of Negri bodies in sections of the hippocampus major. The touch method of making preparations for examination for Negri bodies has not been uniformly successful in our hands, and in practically every case sections have been made of the brain tissues before staining. In only a few cases was it necessary to make inoculations of rabbits to arrive at a diagnosis.

Cases of rabies investigated by the Bureau of Animal Industry during the fiscal year 1908.

Date.	Record No.	Kind of animal.	Source.	Diagnosis by inoculation of rabbits.	Diagnosis by Negri bodies.	Diagnosis by changes in plexiform ganglia.	Persons or animals bitten.
1907.							
July 13	1129	Dog	District of Columbia.	Negative	Negative	Positive	1 child.
Do.	1138	do	Bristol, Tenn.	do	do	None made.	3 dogs.
Do.	1140	do	District of Columbia.	do	do	Negative	1 man.
Do.	1149	do	do	None made[b].	None made[b].	None made[b].	None.
Aug. —	1187	do	do	do	Positive	do	1 woman, scratched.
Do.	1190	do	Charleston, W. Va.	do	Negative	do	(a)
Do.	1199	do	District of Columbia.	do	Positive	do	1 dog.
Sept. —	1208	do	Clover, Va.	do	do	Negative	(a)
Do.	1210	do	District of Columbia.	Negative	Negative	None made.	(a)
Do.	1211	do	Bethesda, Md.	Positive	None made.	do	2 dogs.
Do.	1223	do	District of Columbia.	None made.	Positive	Positive	(a)
Do.	1226	do	do	Positive	do	do	(a)
Do.	1228	do	do	None made.	do	None made.	None.
Do.	1230	do	do	Positive	do	do	(a)
Do.	1231	do	do	None made.	do	do	1 child.
Oct. —	1265	do	do	do.[b]	None made[b].	do.[b]	1 man.
Do.	1267	do	do	do	Positive	None made.	None.
Oct. 29	1281	do	do	do	do	Positive	1 cow and several dogs.
Do.	1283	do	do	do	do	do	1 boy.
Do.	1286	do	do	do	do	None made.	1 woman.

[a] History incomplete, not indicating whether persons or animals had been bitten.
[b] Carcass too badly decomposed for experimental purposes.

Cases of rabies investigated by the Bureau of Animal Industry during the fiscal year 1908—Continued.

Date.	Record No.	Kind of animal.	Source.	Diagnosis by inoculation of rabbits.	Diagnosis by Negri bodies.	Diagnosis by changes in plexiform ganglia.	Persons or animals bitten.
1907.							
Oct. 30	1288	Dog	Silver Springs, Md.	None made	Positive	Positive	2 dogs.
Nov. 4	1289	...do	District of Columbia.	...do [a]	None made[a].	None made[a].	Several children and dogs.
Nov. 11	1301	...do	...do	...do	Positive	Negative	1 man.
Nov. 16	1308	...do	...do	...do	Negative	...do	1 woman.
Nov. 18	1313	...do	...do	Positive	...do	...do	None.
Dec. 4	1335	...do	Norfolk, Va	...do	...do	Positive	2 children.
Dec. 16	1342	...do	District of Columbia.	None made	Positive	None made	3 dogs.
Dec. 21	1354	...do	...do	...do	...do	Positive	2 persons and 3 dogs.
1908.							
Jan. 6	1373	...do	...do	...do	...do	None made	1 man.
Jan. 10	1380	...do	...do	Positive	...do	Positive	Do.
Jan. 20	1391	...do	...do	None made	...do	...do	None.
Feb. 5	1415	...do	...do	...do	...do	...do	Several dogs.
Do	1416	...do	Tuxedo, Md	Negative	None made	...do	None.
Feb. 7	1419	...do	Laurel, Md	None made	Indeterminate.	...do	Do.
Feb. 13	1433	...do	District of Columbia.	...do	Positive	...do	(b)
Feb. 15	1435	...do	Brierfield, Va	...do	...do	None made	(b)
Feb. 17	1442	...do	Herndon, Va	...do	...do	...do	5 persons.
Do	1443	Steer	District of Columbia.	Negative	Negative	Negative	(b)
Feb. 18	1445	Dog	Charleston, W. Va.	...do	Positive	None made	(b)
Feb. 21	1449	...do	District of Columbia.	...do	Negative	Positive	(b)
Feb. 27	1458	...do	...do	...do	...do	Negative	1 boy.
Mar. 11	1477	...do	Arlington, Va	None made	Positive	Positive	None.
Mar. 14	1485	...do	District of Columbia.	...do	...do	...do	1 man.
Mar. 16	1488	Cow	Herndon, Va	...do	...do	None made	(b)
Mar. 17	1492	Dog	District of Columbia.	Negative	Negative	Negative	1 man.
Mar. 18	1495	...do	...do	None made	Positive	None made	Dogs and 1 cat.
Mar. 19	1496	...do	...do	Negative	Negative	Negative	1 boy.
Mar. 25	1510	...do	...do	...do	...do	...do	None.
Mar. 27	1513	...do	...do	...do	...do	...do	Do.
Apr. 8	1533	...do	...do	None made	Positive	None made	(b)
Do	1534	...do	...do	...do	...do	...do	(b)
Apr. 14	1542	Pig	Cedar Rapids, Iowa.	...do	...do	...do	(b)
Apr. 15	1545	Dog	District of Columbia.	Negative	Negative	Negative	1 girl.
Apr. 17	1546	...do	...do	None made	Positive	None made	1 man.
Apr. 20	1558	...do	...do	...do	...do	...do	1 girl.
Apr. 22	1566	...do	...do	Negative	Negative	Negative	1 boy.
Apr. 21	1575	...do	...do	None made			Diagnosed in life.
Apr. 27	1580	...do	...do	...do	Positive	None made	1 man.
Do	1581	...do	...do	...do	...do	...do	2 men.
Apr. 28	1587	...do	...do	...do	Negative	Negative	(b)
May 2	1591	...do	Bethesda, Md	...do	...do	...do	None.
May 4	1592	...do	District of Columbia.	...do	Positive	None made	3 boys.
Do	1593	...do	...do	...do	...do	...do	1 man.
Do	1596	...do	...do	...do	...do	...do	Several dogs and 1 man.
May 8	1603	...do	Charleston, W. Va.	...do	...do	...do	(b)
May 11	1609	...do	District of Columbia.	...do	None made	Positive	3 dogs.
Do	1610	...do	Alexandria, Va	...do	Positive	None made	2 children.
May 13	1614	...do	Richmond, Va	Negative	Negative	Negative	(b)
May 14	1616	...do	District of Columbia.	...do	...do	...do	1 child.
May 15	1620	...do	...do	Positive	...do	...do	1 girl.
Do	1621	...do	...do	None made	Positive	None made	Dogs.
Do	1622	...do	...do	...do	...do	...do	2 children.
May 16	1624	...do	Lamar, S. C	Negative	Negative	Negative	(b)
May 18	1626	...do	Alexandria, Va	None made	None made	Positive	1 man.

[a] Carcass too badly decomposed for experimental purposes.
[b] History incomplete, not indicating whether persons or animals had been bitten.

Cases of rabies investigated by the Bureau of Animal Industry during the fiscal year 1908—Continued.

Date.	Record No.	Kind of animal.	Source.	Diagnosis by inoculation of rabbits.	Diagnosis by Negri bodies.	Diagnosis by changes in plexiform ganglia.	Persons or animals bitten.
1908. May 21	1635	Dog	District of Columbia.	None made.	Positive	None made	1 man.
Do	1636	do	do	do	do	do	Do.
Do	1638	do	do	do	do	do	Do.
May 22	1639	do	do	do	do	do	Do.
May 23	1640	do	do	Negative	Negative	Negative	2 people.
May 25	1642	do	do	None made	Positive	None made	1 man and 1 dog.
Do	1643	do	Norfolk, Va	do	do	do	1 child.
Do	1644	do	District of Columbia.	Negative	Negative	Negative	Do.
May 26	1646	do	do	None made	Positive	None made	None.
May 27	1648	do	Arlington, Va	do	do	do	3 dogs.
May 29	1649	do	District of Columbia.	Negative	Negative	do	(a)
May 30	1652	do	do	do	do	Negative	1 girl.
June 1	1655	do	do	do	do	do	1 boy.
Do	1659	Cat	do	do	do	do	1 man.
June 5	1660	Dog	do	None made	Positive	None made	1 dog.
June 3	1662	do	do	Negative	Negative	do	2 persons.
June 4	1663	do	do	None made	Positive	do	1 dog.
June 5	1666	Cat	Bethesda, Md	do	do	do	(a)
June 6	1668	Dog	District of Columbia.	do	do	do	1 child and 1 dog.
Do	1669	do	do	do	do	do	1 man.
Do	1671	do	do	do	do	do	(a)
June 8	1672	do	do	Negative	Negative	Negative	Several dogs.
Do	1673	do	do	None made	Positive	None made	1 boy.
June 9	1677	do	do	Positive	Negative	Negative	(a)
June 10	1682	do	do	Negative	do	None made	1 man.
Do	1683	do	do	None made	Positive	do	1 boy.
June 11	1684	do	do	do	do	do	2 dogs.
June 12	1685	do	do	Positive	Negative	do	1 boy.
Do	1686	do	do	Negative	do	do	Do.
June 13	1688	do	do	do	do	do	Do.
June 14	1689	do	do	None made	Positive	do	4 dogs.
June 15	1690	do	do	do	do	do	1 man.
Do	1691	do	do	do	do	do	2 persons.
June 16	1692	do	Glen Echo, Md	Negative	Negative	Positive	Do.
Do	1693	Cat	Tacoma Park, Md.	Positive	do	do	1 child.
June 18	1696	Dog	District of Columbia.	Negative	do	Negative	Do.
Do	1698	do	Upperville, Va	None made	Positive	None made	(a)
June 23	1700	do	District of Columbia.	Negative	Negative	Negative	2 children.
Do	1701	do	do	None made.	Positive	None made.	1 boy.
June 27	1704	do	do	do	do	do	(a)
Do	1705	do	Charleston, W. Va.	do	do	do	(a)
June 29	1707	do	District of Columbia.	do	do	do	1 dog.
Do	1708	do	do	do	do	do	None.

[a] History incomplete, not indicating whether persons or animals had been bitten.

DISTRIBUTION OF BLACKLEG VACCINE.

The free distribution of blackleg vaccine continues to be an important feature of the routine work of the Pathological Division. During the fiscal year ending June 30, 1908, about 1,200,000 doses of vaccine have been prepared in the pathological laboratory and distributed among stock owners. The great demand for this product shows the continued confidence of stock raisers in its value as an immunizing agent against this virulent disease.

The results of the vaccination for the year ending June 30, 1907, as reported to the Bureau by the stock raisers who have used the vaccine, are as follows:

Results of use of blackleg vaccine, year ending June 30, 1907.

State or Territory.	Number of cattle vaccinated.	Deaths same season previous to vaccination.		Died after vaccination.					
		Number.	Per cent.	Within 48 hours.	From 2 to 7 days after.	Within 1 year.	Total number.	Percentage of deaths after vaccination.	Number of cases due to mistakes.
Arizona	6,330	382	6.03	17	7	22	46	0.726	....
Arkansas	613	14	2.28	....	....	1	1	.163	....
California	53,740	465	.86	12	30	67	109	.2	1
Colorado	59,096	691	1.16	26	39	176	241	.373	20
Idaho	2,784	61	2.19	2	2	9	13	.43	1
Illinois	2,379	65	2.73	5	1	4	10	.42	....
Iowa	13,524	88	.65	4	4	57	65	.47	....
Kansas	36,791	492	1.33	12	16	68	96	.258	1
Kentucky	588	22	3.74	....	....	1	1	.17	....
Michigan	108	2	1.85	....	1	....	1	.85	....
Minnesota	1,189	62	5.13	1	....	1	2	.16	....
Mississippi	60	7	1.16	....	....	....	....	....	....
Missouri	17,928	190	1.05	1	9	39	49	.27	....
Montana	24,123	289	1.19	4	11	98	113	.44	6
Nebraska	115,830	1,932	1.6667	45	100	357	502	.428	6
Nevada	880	19	2.15	....	....	....	....	....	....
New Hampshire	11	....	....	....	....	....	....	....	....
New Mexico	15,897	458	2.87	9	13	143	165	1.03	....
New York	355	4	1.12	....	....	1	1	.27	....
North Carolina	1,919	43	.213	1	1	10	12	.62	....
North Dakota	35,298	467	1.32	7	13	135	155	.43	....
Ohio	18	....	....	....	....	....	....	....	....
Oklahoma	6,523	83	1.27	4	4	5	13	.197	....
Oregon	14,124	86	.6	....	2	16	18	1.27	....
Pennsylvania	24	1	4.16	....	....	....	....	....	....
South Dakota	45,559	878	1.92	20	53	237	310	.68	....
Tennessee	2,287	78	3.41	1	1	6	8	3.47	....
Texas	165,143	2,099	1.27	35	146	1,038	1,219	737	1
Utah	1,854	48	2.52	....	2	....	2	.107	....
Vermont	58	5	8.6	....	....	1	1	1.72	....
Virginia	9,354	148	1.58	1	13	55	69	.73	....
Washington	777	43	5.53	1	....	....	1	.128	....
West Virginia	3,429	62	1.18	2	3	17	12	.34	....
Wisconsin	373	63	1.68	....	....	....	....	....	....
Wyoming	51,862	687	1.32	17	36	170	223	.429	....
Total and average	690,828	10,034	1.431	227	507	2,734	3,458	.50	36

An examination of the foregoing table shows, when compared with the records of previous years, a decrease in the percentage of animals dying of blackleg without being vaccinated; also in the number of animals dying subsequent to vaccination. Eliminating the number of cattle dying within forty-eight hours after vaccination, as a result of being previously infected, and those whose death has been due to mistakes in vaccinating, the number of cattle dying after vaccination is reduced to 3,195, or only 0.46 per cent. The annual losses to stock raisers previous to the use of blackleg vaccine ran as high as 10 or 12 per cent of all the calves raised in the infected districts.

AUTOPSIES OF WILD ANIMALS.

As heretofore, the large number of wild animals sent to the pathological laboratory by the National Zoological Park for autopsy presented many interesting pathological conditions. The results of postmortems held on 112 animals show that diseases of the digestive and respiratory tracts are responsible for more than one-half of the deaths of the wild animals at the park. Tuberculosis was by no means rare, and especially was this true in the case of monkeys. Autopsies were performed on 15 monkeys, 10 of which died of tuberculosis. Post-mortems on birds revealed the fact that a large number of deaths were due to aspergillosis of the lungs. This was especially noticeable at the autopsies of aquatic birds—wood ducks, cranes, and flamingoes being particularly affected.

RAT VIRUS INVESTIGATIONS.

The ravages by rats and mice are of importance from an economic standpoint, but these animals also disseminate diseases, which fact has again been established in the recent outbreak of bubonic plague on the Pacific coast. This induced some of the commercial firms to prepare viruses with the object of producing an infectious disease which, while destructive to rats and mice, would prove harmless to all domesticated animals. There existed various such preparations on the market, but extensive tests with them proved their infectiousness for other animals besides rats and mice. Recently several new products of this kind were placed on the market, and, following requests from various sources, the Pathological Division undertook an investigation of these products in order to determine their effectiveness.

The samples for the test were purchased from local drug stores and the directions for their use were carefully followed. Three rats were given two large feedings of the virus and were then placed with three control rats, all in one cage. The same procedure was followed with guinea pigs, rabbits, chickens, and mice. There was no effect whatever noted from the feeding of these animals; they continued well and have failed to show the slightest indication of infection. Subsequently fresh rats and other test animals were given a subcutaneous inoculation with emulsions from the rat viruses, but this also failed to produce any noticeable disturbance in the health of the animals. Thus the experiments clearly demonstrated the ineffectiveness and unreliability of the preparations tested.

POULTRY AND BIRD DISEASES.

The number of birds and chickens brought to autopsy during the past year is considerably in excess of that of the year previous. The

various diseases occur in about the usual proportions. Careful examinations of the intestines of all poultry examined has revealed the frequent presence of the protozoan organism *Coccidium tenellum*.

The most important feature of the continued investigation of white diarrhea of chicks has been the successful differentiation between what is frequently termed "incubator or brooder pneumonia" and cheesy inflammation of the ceca. The earlier studies in white diarrhea revealed the fact that the caseo-necrotic inflammation of the ceca—resulting in great distention of the blind pouches, white diarrhea, and death—was due to the presence of *Coccidium tenellum* and should be denominated coccidial typhilitis.

Quite a number of poultrymen were inclined to claim that the investigations were faulty in that they failed to note the presence of cheesy nodules in the lungs and sometimes throughout the body cavity. As it was quite evident that the nodules in the lungs were not caused by coccidia, careful examination was made of them and cultures taken from them, resulting, in about 95 per cent of all cases, in the cultivation of a mold, usually *Aspergillus fumigatus*, sometimes *A. glaucus*. Several opportunities having occurred to investigate outbreaks among chicks which had shown previous to death evidences of diarrhea, it was discovered that some of the outbreaks showed at post-mortem only the nodular caseation of the lungs and no affection of the ceca. In these cases no coccidia were to be found in the intestines, whereas the cheesy nodules regularly revealed the mycotic disease.

It was thus established that what is commonly spoken of as white diarrhea in chicks really includes at least two diseases, which may sometimes occur simultaneously in the same bird. The cases characterized by cheesy foci in the lungs, called "lungers" by poultrymen, should be recognized as cases of pneumomycosis in chicks, produced most frequently by the mold *Aspergillus fumigatus*, and may therefore be designated as cases of aspergillosis. The cases characterized by distended and cheesy ceca invariably show the presence of coccidia and should therefore be known as coccidiosis.

SARCOMATOSIS IN CHICKENS.

During the year an increasing number of the chickens received at the pathological laboratory showed that death was produced by extensive distribution of sarcomatous growths. In most of the cases the intestines and the peritoneum were the seat of invasion. One instance, however, deserves special mention, inasmuch as the tumor fibrosarcoma in this case destroyed not only the kidneys, but extended into the muscles of the back and of the legs.

WORK OF PATHOLOGICAL LABORATORY IN CHICAGO.

The work at the branch pathological laboratory located at Chicago, Ill., has steadily increased. The veterinary inspectors at the various stations tributary to Chicago have forwarded a large number of specimens for microscopical diagnosis.

Two specimens of special interest were new growths in the livers of sheep, one a multiple tumor (lieo myoma) springing from the middle coat (tunica media) of the arteries, the other a hypernephroma involving one lobe of the liver. It seems that such tumors occurring in the livers of sheep have not been previously reported in the literature dealing with pathological subjects. A very interesting pathological change was observed in the lung of a steer. In this specimen there was an ossification of the walls of the air vesicles; in places true Haversian systems were formed in the bony plates.

During the year it was observed by the veterinary and meat inspectors in Chicago that a large number of tongues of slaughtered cattle contained eroded areas of various sizes at the bottom of the dorsum cecum of the member. The tongues of 840 slaughtered cattle, ranging from two years of age to adult animals, were examined microscopically, and 100 were found to contain eroded areas. Sections from these were prepared for microscopical examination and 79 were found to contain awns or beards of grain or grasses which had penetrated into the tissue beneath. In 49 of these cases colonies of actinomyces were found growing either free in the tissue or around the penetrating end of the awn.

THE BIOCHEMIC DIVISION.

This division, of which Dr. M. Dorset is chief, has been engaged during the year chiefly in the laboratory inspection of meat products, investigations concerning hog cholera, and tests of stock dips, besides continuing the preparation and distribution of tuberculin and mallein.

LABORATORY MEAT INSPECTION.

In the report for the fiscal year 1907 the establishment of a systematic laboratory inspection of meat food products was described. During that year a great portion of time was spent in properly organizing the work.

During the fiscal year just ended this laboratory inspection has increased greatly in thoroughness and has been shown to be necessary for the proper enforcement of the meat-inspection law. The various laboratories have examined during the past fiscal year more than 12,000 samples collected from establishments in all parts of the country. Of these samples approximately 5 per cent have been found to be in conflict in one way or another with the regulations govern-

ing meat inspection. These samples consisted of a great variety of substances, such as canned meats, cured meats, fresh meats, sausages, cooked meats, flours, lards, lard substitutes, miscellaneous oils and fats, including tallow, oleo oils, stearin, etc., pickling solutions, soups, preserving salts, coloring matters, and water used in the preparation of meats. The greater portion of these samples were taken from establishments having inspection, though a considerable number were taken from houses operating under certificates of exemption. A far greater proportion of the samples from houses operating under exemption certificates were found to be in conflict with the regulations than was the case with samples from houses having inspection.

A very small number of meats were found to contain prohibited preservatives. The preservatives found were usually sulphurous acid or its salts, and occurred in the vast majority of cases in fresh chopped meats from establishments operating under a certificate of exemption. In the case of canned meats the chief violations consisted in the presence of cereals without this being shown on the label. Occasionally it was found that goods of this character were short in weight. Lards, lard substitutes, tallows, oleo oils, stearins, etc., were found to be almost without exception labeled properly and in good condition. In one case at least the discovery of adulteration in lard resulted in the withdrawal of inspection from an establishment. A few products were condemned owing to unsoundness or the presence of dirt, but as a general rule the products submitted were found clean and wholesome.

During the fiscal year sanitary analyses were made of water supplies from 70 different establishments where inspection is maintained. These samples were collected in all cases where there was reason to suspect the unwholesomeness of the water used in the preparation of meats and meat food products. The examinations resulted in the condemnation of a considerable proportion of the samples submitted, and steps have been taken to remove the sources of pollution where this could be done, and where this was not practicable an entirely new water supply has been installed.

RESEARCH WORK.

In addition to the routine inspection of meats and meat food products, a considerable quantity of research work has been carried out along the following lines:

The action of saltpeter upon the red color of meats.—The results of this work show that the red color of cured meats is due to the indirect action of saltpeter upon the coloring matter of the blood, the saltpeter being reduced and the hemoglobin of the blood entering into combination with nitric oxid to form nitric oxid hemoglobin, which is a stable red color.

The detection of beef fat in lard.—At the beginning of the laboratory inspection considerable difficulty was found in determining through existing methods the presence of small quantities of beef fat in lard. As a result of extensive trials a method was developed which is simple and which serves to reveal the presence of very small quantities of beef fat mixed with lard; this is now employed in the routine examination of this class of products, and it is expected that the method will be of value to others engaged in similar work. This method has been described in Bureau Circular 132.

The use of sulphur dioxid in smokehouses and storerooms.—Laboratory experiments showed that when sulphur is burned in closed compartments where meat is kept the sulphur dioxid which is liberated is absorbed by the meat, the amount absorbed depending directly upon the condition of the meat in regard to moisture. Fresh meats absorb sulphur dioxids in large amounts, while smoked meats take up very much less. Examinations have been made of hams from smokehouses which had been fumigated with sulphur dioxid while the meats were still hanging therein, and sulphur dioxid has been found even when the meats were comparatively dry, though not in large quantities. A careful inquiry was made concerning the necessity for the use of sulphur dioxid in preventing damage to meats by skipper flies, and as a result it was found that most of the packing-house superintendents think this is unnecessary, provided sufficient care is taken in screening the smokehouse and storerooms and in preventing the introduction of skipper flies through meats from the outside which are already infested.

The preparation and composition of meat extracts.—A considerable amount of experimental and practical work has been conducted along this line, and a report of the results will probably be issued during the ensuing fiscal year.

Analytical methods.—In all cases where existing methods of analysis have been found unsatisfactory in any respect efforts have been made to improve the technique and methods of procedure.

Investigation of canning methods.—During the year the question as to the proper disposal of slow-leaking cans was brought up for decision, certain packing houses claiming that they should be allowed to open and reprocess these cans provided they did not show evidence of changes discernible through the odor or general appearance. A careful study of cans of this character was made, and the following conclusions were reached:

1. The majority of slow-leaking cans contain bacteria which invariably set up putrefactive or fermentative changes in the contents of the cans.

2. The majority of slow-leaking cans, when incubated for ten days at a temperature of 100° to 110° F., will develop into "swellers."

3. Short-vacuum, overstuffed, and collapsed cans will not swell upon incubation provided there are no breaks in the tins.

4. The swelling of slow-leaking cans upon incubation is due to the formation of gases resulting from the growth of bacteria within the cans.

5. The product contained in slow-leaking cans is not a safe article for food even though it be reprocessed.

As a result of this investigation the reprocessing of slow-leaking cans has been prohibited. A paper reporting this work more in detail has been included in the Twenty-fourth Annual Report of the Bureau.

Investigation of the cause of meat souring during the process of curing.—In addition to the importance of this question from a public-health standpoint, it is one of considerable moment to the packers, who suffer large losses through the condemnation of meats which become sour before the curing is completed. Extensive experiments under practical conditions to determine the effects of chilling meats for longer or shorter periods of time prior to their being placed in cure have been carried out, and the effect of overheating animals at the time of slaughter, together with the part played by certain diseased conditions, have been given extensive study. In conjunction with these practical experiments bacteriological examinations have been made of a large number of sour hams and of pickling solutions in which these were cured, and numerous bacteria have been isolated. These experiments have not yet been concluded. The effect of the bacteria isolated from sour hams and normal hams upon the curing process is now being studied.

BRANDING INK.

In the last annual report the statement was made that an ink had been devised to be used for marking inspected carcasses, but at that time this ink had not been given a thorough trial and the results of its use in practice could not be stated. During the past fiscal year 2,150 gallons of this ink were prepared and forwarded to all establishments in the United States where fresh meats are prepared under Bureau inspection. Inspectors in charge of establishments where this marking is carried out have reported almost without exception that the ink when applied with a properly made metal brand gives entirely satisfactory results. By far the greater proportion of these inspectors state that the ink is much superior to the labels which were formerly used for the same purpose. The total cost of the ink required for applying the inspection mark during the year, including labor and brands, was $2,866.

ANIMAL DIPS.

EXAMINATION OF DIPS OFFERED FOR OFFICIAL DIPPING.

During the year approximately 185 different samples of dips and dipping solutions have been sent to the Bureau for examination. These included 10 lime-and-sulphur solutions, 4 arsenic-and-sulphur solutions, 30 cresol dips, and 141 coal-tar creosote dips. The composition of many of these substances as shown by the formulas submitted was such as to preclude their use in official dipping under the regulations. A considerable number upon a preliminary examination showed imperfect incorporation of the ingredients or lack of proper emulsifying qualities. After eliminating a number for these causes there were submitted to a thorough chemical examination the following: Ten lime-and-sulphur solutions, 4 arsenic-and-sulphur solutions, 15 cresol dips (of which 10 were rejected), and 114 coal-tar creosote dips (of which 13 were rejected). At the close of the fiscal year there remained in the laboratory between 15 and 20 dips of all classes to be examined. A few samples of crude petroleum were analyzed, and a number of other miscellaneous analyses of related substances were executed.

A gratifying feature of this inspection of proprietary dips has been the marked improvement noticeable in the quality of coal-tar creosote dips. At the beginning of the year many very low-grade solutions were submitted which contained considerable proportions of water or other inactive substances. When the manufacturers realized that the proportions in which their dips would be permitted in official dipping depended exclusively upon the amount of active ingredients in their products, they at once found it to their interest to place on the market dips which would be as concentrated as possible, with inactive substances such as water eliminated. Although such concentrated dips when diluted for dipping are not more efficient as curative agents than one of less concentrated qualities which is diluted to a lower degree, it seems evident that the action of the Secretary of Agriculture in permitting the use of proprietary dips in official dipping under definite restrictions with respect to composition has been of benefit to both the manufacturer and the consumer, in enabling the former to sell his goods squarely on their merits and in assuring to the latter the opportunity to purchase these dips with some degree of confidence as to their action.

RESEARCH AND EXPERIMENTAL WORK.

The methods of analyzing coal-tar dips which were available at the time of the Secretary's order permitting such dips of certain compositions to be used in official dipping were far from satisfactory, and it became necessary to place these methods on a more scientific

basis in order to enforce the regulations satisfactorily. A large amount of experimental work was carried out along these lines and a method was developed which is believed to give accurate and concordant results. This study and the results obtained have been published as Bureau Bulletin 107, prepared by Mr. R. M. Chapin, who conducted the research work.

The Biochemic Division has also cooperated with the Zoological Division in testing dips of various compositions upon cattle. For this purpose a total of 280 gallons of dip was prepared and analyzed. The final result of these experiments has not yet been determined.

HOG CHOLERA.

Satisfactory progress has been made in the work of producing a vaccine for hog cholera. A report of the experimental work was made in the last annual report. Since that time practical field tests of the method have been carried out on 50 different farms, a total of approximately 2,000 animals being vaccinated. On some of these farms the serum was administered alone and on others the serum was given simultaneously with a small dose of disease-producing blood. The herd conditions varied widely, though they may be classified roughly as follows:

(*a*) Herds in an infected district, but which were themselves free from disease.

(*b*) Herds which were known to have been exposed by contact with hogs sick of hog cholera, but which had not developed disease at the time of treatment.

(*c*) Herds in which hog cholera was present and hogs were sick and dying at the time of treatment.

In no cases were any of the ordinary methods of combating hog cholera by quarantine and disinfection employed. In cases where disease was present at the time of treatment or where it appeared subsequent to treatment, the treated animals were allowed to run with the sick animals along with a number of untreated animals which served as controls on the action of the serum. It will thus be seen that the success following the treatment can be attributed only to the action of the serum.

In herds where hog cholera appeared subsequent to treatment and which had not been exposed prior to treatment all of the vaccinated hogs remained well, while more than 64 per cent of the checks died. In the herds which had been exposed prior to treatment, but which were apparently well at that time, only 4½ per cent of the treated hogs died, while approximately 90 per cent of the checks were lost. In the herds where the disease existed at the time of treatment 13 per cent of the treated animals succumbed, whereas 74 per cent of the checks died.

In view of these successful field tests, and as the method seemed cheap enough to warrant its practical use, invitations were extended to a number of the more important hog-raising States to send representatives to the Bureau experimental farm at Ames, Iowa, for the purpose of observing the work and also to consider plans for the practical application of this method of combating hog cholera. This conference was held at Ames on May 25, 1908, and there were present representatives from Iowa, Nebraska, Kansas, Arkansas, Missouri, Indiana, Ohio, Michigan, and Minnesota. These representatives expressed themselves as convinced that the method was worthy of an extensive practical application, and in a number of instances at least this work has been taken up by the States with a view to distributing the serum to the farmers by the proper State officials. Other conferences have been arranged for and it is hoped that this work will be well organized and that the different States will soon take up the production and distribution of the serum.

Aside from the foregoing work, a number of experiments dealing with various phases of the hog-cholera problem have been carried out, but these have not reached a point where a report of results is warranted.

SANITARY EXAMINATION OF WATER SUPPLY OF DAIRY FARMS.

This work consisted in the sanitary inspection of practically all the dairies which supply milk to the District of Columbia. In addition to the sanitary survey, chemical analyses and bacteriological examinations were made of all the water supplies. As a result of this work it was found that a large number of dairies were using water which was questionable in so far as its sanitary condition was concerned. In every instance the dairymen were instructed as to the best methods of improving the water supply, and the result of this work has been that the insanitary conditions of many wells and springs supplying these dairies have been rectified. The data obtained in this work have been embodied in papers prepared for a report upon milk issued by the United States Public Health and Marine-Hospital Service and for the Yearbook of the Department of Agriculture for 1907.

WORK WITH DISINFECTANTS.

A considerable amount of bacteriological work has been carried out with coal-tar disinfectants, especial attention being given to coal-tar hydrocarbons. This work, while it has progressed satisfactorily, is not yet in such condition as to warrant a report, though it may be said that the examinations up to the present time show that the constitutents of coal-tar disinfectants, other than cresols and related bodies, are practically without bactericidal effect.

TUBERCULIN AND MALLEIN.

The experiments concerning a standard method for the preparation of tuberculin have been continued and considerable progress has been made. The distribution of tuberculin to State, county, and city health officers has been continued, the demand having increased considerably during the past year. The total amount of tuberculin shipped out during the fiscal year just ended was 213,015 doses, as compared with 129,050 doses during the preceding year. All reports upon this subject indicate that the tuberculin prepared and distributed by the Bureau has been of good quality and has given uniformly successful results.

The distribution of mallein to health officers has also been continued, and 52,556 doses were distributed during the fiscal year. This exceeds the amount sent out during the previous fiscal year by more than 10,000 doses.

THE ZOOLOGICAL DIVISION.

This division, under Dr. B. H. Ransom, as chief, has continued its work of investigating animal diseases of parasitic origin, collecting and determining animal parasites, and preparing publications relating to these subjects.

ROUNDWORMS OF SHEEP.

The investigations concerning roundworms parasitic in sheep, with special reference to the twisted stomach worm, have been continued. The experiments carried on in 1908, and which were uncompleted at the close of the fiscal year, have concerned the problem of keeping lambs free from infestation with these parasites. Two methods of handling the sheep have been tried. In one the lambs and their worm-infested mothers were kept together and changed at intervals to different pastures, the lambs when weaned being placed finally in a pasture separate from the ewes. In the other method the ewes and lambs were kept separate in adjacent pastures with a bare earth pen between, into which the lambs were frequently turned with the ewes for sucking, the animals afterwards being returned to their proper pastures. In addition another set of experiments is in progress in which an attempt is being made to determine the effects of feeding tobacco upon parasitic infection in sheep.

It is planned to provide during the coming year for practical trials, under farm conditions, of methods for avoiding the infestation of sheep with parasites, in case the results of the experiments now in progress at the Bureau Experiment Station are sufficiently favorable to justify such extension of the work.

GID IN SHEEP.

The investigation of this important parasitic disease, due to a tapeworm cyst found in the brain as a result of infection with eggs of tapeworms from dogs, has been continued along the lines mentioned in the last report. As yet no definite reports of the existence of this disease in other States than Montana have been received.

SHEEP SCAB.

A set of experiments in the treatment of sheep scab supplementary to earlier experiments in cooperation with the Biochemic Division of this Bureau and the South Dakota Experiment Station came to an untimely end on account of the destruction of nearly all the experimental sheep by dogs. A kerosene mixture tested as a remedy for sheep scab at the South Omaha Stock Yards proved to be unsatisfactory for this purpose. A bulletin relative to sheep scab is in preparation.

CATTLE MANGE.

A series of experiments in the treatment of cattle mange, with reference to the efficiency of coal-tar dips for this purpose, has been begun in cooperation with the Biochemic Division of this Bureau and the South Dakota Experiment Station.

INVESTIGATIONS BEARING ON TICK ERADICATION.

Experiments in the treatment of cattle for ticks with various substances applied by means of dipping vats and spraying machines have been carried out. These experiments demonstrated that a 20 per cent emulsion of some kinds of crude petroleum is very effective when applied by means of either a dipping vat or a spraying machine, only a small fraction of 1 per cent of the ticks surviving the treatment. A few animals which were treated a second time forty-eight hours after the first application were entirely freed of ticks. The injury to the cattle by the treatment was exceedingly slight and of no practical importance.

One kind of crude oil which was tried failed to give good results. It emulsified with difficulty and killed only a small proportion of the ticks. Various percentages of cresylic acid combined with kerosene, and with the kind of crude oil just mentioned, in emulsion with water failed to kill more than a part of the ticks, even when the percentage of cresylic acid was raised to a point at which it poisoned (but not fatally) the cattle treated.

Next in efficiency to an emulsion of a crude oil of proper composition was an arsenical solution containing nearly 0.2 per cent of arsenic by weight and 0.2 per cent of pine tar by volume. In this

case also only a small fraction of 1 per cent of the ticks survived the treatment. The injury to the cattle was perhaps even less than that noted when oil emulsion was used.

These experiments indicate that from the standpoint of tick eradication both the oil emulsion and the arsenical solution are valuable agents for the purpose of destroying ticks on cattle. It is believed that, by repetitions of the treatment at proper intervals, even though some few ticks may occasionally survive, extermination of the ticks in pastures where the cattle are thus treated may be finally accomplished. In view of the fact that some ticks are likely to survive the treatment with oil emulsion or arsenical solution, it is evident that these preparations can not be safely employed for cattle which are to be moved from quarantined areas except for slaughter. Whether repetition of the treatment within a few days following the first treatment would be sufficient to render such movements of cattle safe is a subject for further investigation.

The first year's work in investigations bearing on tick eradication which have been conducted in cooperation with the Alabama Agricultural Experiment Station and the Alabama Live Stock Sanitary Board has been completed, but the results have not yet been compiled.

INVESTIGATIONS CONCERNING PARASITIC PROTOZOA.

The existence in the United States of various diseases of domestic animals due to parasitic protozoa demands that this class of parasites receive more attention than has heretofore been given to them in this division. To supply this need an assistant, who will be employed in investigations in this field, has been appointed.

INDEX-CATALOGUE OF MEDICAL AND VETERINARY ZOOLOGY.

Parts 18, 19, and 20 of this catalogue have been issued during the year, and the first part of the subject-catalogue, comprising the Trematodes, which has been prepared in cooperation with the Division of Zoology of the Hygienic Laboratory, United States Public Health and Marine-Hospital Service, has been issued as Bulletin 37 of that laboratory.

COLLECTION OF PARASITES.

The total number of specimens in the helminthological collection of the Bureau is now more than 5,000, consisting of over 3,000 bottles and about 250 jars of material preserved in alcohol, and more than 2,000 microscopic slides. The constant growth of this collection has made it necessary to devote more and more time to its care. During the past year 528 new entries were made in the catalogue of this col-

lection, about 100 of which represent specimens sent in for identification, most of the remainder having been collected by members of the Zoological Division. During the fiscal year about 130 post-mortem examinations of various animals, domesticated and wild, have been made with reference to the existence of parasitic infection.

Various educational institutions and scientific investigators have been supplied with duplicate specimens from the collection, and a number of specimens have been received in exchange.

THE EXPERIMENT STATION.

The general character of the work at the Bureau Experiment Station during the past year has been similar to that of former years, consisting of independent original investigations as well as investigations in cooperation with the other scientific divisions of the Bureau. The station, which is located at Bethesda, Md., and is in charge of Dr. E. C. Schroeder, superintendent, provides facilities for work of a kind that requires farm and field conditions not obtainable within the city.

TUBERCULOSIS.

On the subject of tuberculosis two circulars, Nos. 118 and 127, were published. In the former the observations made relative to apparently healthy but dangerously tuberculous cows were discussed, and in the latter circular investigations were reported regarding the length of time tubercle bacilli remain alive and virulent in dairy products, and especially in butter. Two papers dealing with tuberculous infection through milk were also prepared by the superintendent of the station and presented respectively at meetings of the New York milk committee and the American Association of Medical Milk Commissions.

It is now known from the work of the Experiment Station that apparently healthy cows are frequently affected with tuberculosis; that about 50 per cent of such tuberculous cows scatter tubercle bacilli from their bodies; that the commonest channel for the elimination of tubercle bacilli from the bodies of tuberculous cattle is per rectum with the feces, and that ordinary market milk contains cow feces in varying quantities so commonly that it is no exaggeration to say that very little such milk is sold that does not contain at least a trace of cow feces. The conclusion follows logically from these facts that it is impossible to obtain milk at all times free from tubercle bacilli either from tuberculous cows directly or from healthy cows that are stabled, pastured, or otherwise permitted to come into contact with tuberculous cows or the material that passes from their bodies.

Relative to butter, it was shown that tubercle bacilli may remain alive and virulent in ordinary salted butter fully one hundred and

sixty days, or five and one-third months, and that at the end of three months they show only a doubtful reduction in pathogenic virulence.

A large number of samples of commercial or market milk from various dairies supplying milk to the city of Washington were tested in the course of the year, and something more than one sample out of every twenty was found to be infected with tubercle bacilli. It was also discovered that dairies which distribute milk infected with tubercle bacilli do so intermittently and not continuously or uninterruptedly. For example, one dairy, tested on ten consecutive days, was found to be distributing infected milk on the second, third, and eighth days, and milk apparently free from tubercle bacilli on the remaining seven days. When this intermittent occurrence of tubercle bacilli in the milk from infected dairies is taken into consideration, we may reasonably conclude that the presence of infection in about 5 per cent of the samples of milk examined at the station is a much more serious condition than it at first appears to be. If it is necessary to examine from three to five samples of milk from a dairy to determine the fact that the dairy is distributing tuberculous milk, then the occurrence of tubercle bacilli in five samples among a hundred from 100 different dairies implies that from three to five times five dairies, or from 15 to 25 among the hundred, intermittently distribute tuberculous milk. This is very important, because the number of infected dairies, rather than the percentage of infected milk, determines the extent to which the public is exposed to virulent tubercle bacilli through the use of milk and dairy products.

The intermittent occurrence of tubercle bacilli in the milk of infected dairies is a condition parallel to the intermittent passage of tubercle bacilli from the bodies of cows per rectum with the feces. The station has shown that cattle affected with tuberculosis may pass enormous numbers of tubercle bacilli with their feces for two or three days, and then fail to pass them in numbers sufficiently large to enable their detection for a period of time varying from a few days to several weeks.

In Circular 118 it was shown that over 40 per cent of the animals in a herd of apparently healthy but tuberculous cattle were found to be passing tubercle bacilli from their bodies per rectum. These same cattle have now been under observation for about two years. With the exception of one or two, they have still the appearance of health, but the number passing tubercle bacilli per rectum has increased to nearly 90 per cent. The careful examination of additional cattle, apparently healthy but tuberculous, has confirmed the earlier conclusions regarding the dangerous manner in which cows that are not suspected to be tuberculous until they are tested with tuberculin may scatter tubercle bacilli.

Further confirmatory evidence has been obtained regarding the important rôle played by the feces of tuberculous cattle in the production of tuberculosis among hogs. Experiments have been and are now in progress to determine the extent to which the increasing prevalence of tuberculosis among hogs may be due to tuberculous brood sows.

A considerable amount of work has been done relative to the resistance of tubercle bacilli to natural germ-destroying agents, such as drying, sunlight, ordinary daylight, artificial light, etc. This work shows that exposure of tubercle bacilli to direct sunlight for very short periods of time wholly destroys their pathogenic character and probably kills them. Daylight, artificial light, and simple drying are much slower in their germicidal action.

Investigations relative to the immunization of cattle against tuberculosis and for the treatment of cattle affected with tuberculosis are still in progress. This latter work is being done by the station in cooperation with the Pathological Division.

RABIES.

One case of rabies that occurred in a horse merits special attention, in view of the prevalence of this disease in and near the District of Columbia. The horse was bitten June 4, 1907, brought to the station June 5, remained well until September 25, and was killed on September 26, after it had fractured one of its hind legs during violent paroxysms of acute rabies. The dog that bit the horse was shown by the Pathological Division to have been affected with rabies. The time that elapsed after the horse was bitten before it developed rabies was one hundred and thirteen days, or nearly four months. The horse was kept under conditions which absolutely excluded its infection with the virus of rabies after it reached the station.

TUBERCULIN TESTS.

For some time the station has been preparing to test the various brands of commercial tuberculin commonly sold in the United States. The facilities are so far completed that it is hoped the necessary tests can soon be made and a publication prepared designating the brands of tuberculin found reliable and those found unreliable.

OTHER INVESTIGATIONS.

Investigations relative to infectious abortion, sheep scab, loco of sheep, gid, internal and external parasites of sheep, Texas fever (including the life history of the micro-organism of Texas fever), swamp fever, anthrax, blackleg, hog cholera, etc., have been conducted during the year and are still in progress.

The infectiousness of the progeny of cattle ticks that matured on a sheep was tested by placing them on cattle. The cattle did not

contract Texas fever, and hence it is assumed that cattle ticks grown on other hosts than cattle are free from Texas-fever infection. This assumption is strengthened by the fact that the progeny of cattle ticks that matured on donkeys were found a number of years ago at the station to be noninfectious.

The evidence we have that cattle ticks grown on other hosts than cattle are not carriers of the infection of Texas fever should not lead to the mistaken conclusion that such ticks can be ignored in tick-eradication work. Noninfectious cattle ticks become again infectious by growing a single generation on the body of a southern cow immune to Texas fever, or on the body of any bovine animal that has at some time been affected with and has apparently recovered from Texas fever. Cattle recovered from and cattle immune to Texas fever present, in the strictest sense of the word, chronic cases of Texas fever, and constitute the main and probably the only source from which cattle ticks derive the infection they carry.

INVESTIGATIONS IN ANIMAL BREEDING.

In cooperation with the Animal Husbandry Office of the Bureau, careful investigations regarding the laws of heredity are being made at the Experiment Station, with special reference to the applicability of Mendel's law of heredity to animals. The subjects of inbreeding, telegony, sex control, selective breeding, cross breeding, and the production of useful new hybrids are also being carefully studied. This work is constantly growing and promises in time to give results of importance. One zebra-ass hybrid was born at the station in the course of the year, but the little animal was too weak to live. Several asses are now heavy with foal to the first zebra used at the station. The attempts made to impregnate mares from the zebra have thus far failed, but it is hoped that this branch of the hybrid investigations will give better results in the future.

GENERAL ROUTINE WORK.

The general routine work of the station during the year has been the same as in other years. A number of local outbreaks of disease have been investigated, many tons of green feed have been raised, and a large number of rabbits, guinea pigs, rats, etc., have been bred for the use of the Bureau and its various divisions.

THE ANIMAL HUSBANDRY OFFICE.

The Animal Husbandry Office, under the direction of Mr. George M. Rommel, Animal Husbandman, has continued its work relating to the breeding and feeding of live stock and poultry, the supervision of pedigree record associations, etc.

HORSE BREEDING.

COLORADO WORK.

The experiment in breeding American carriage horses, which is being carried on at Fort Collins, Colo., in cooperation with the Colorado Experiment Station, continues to progress in a highly satisfactory manner. The cooperation is now arranged so that it is practically equal, the station and the Bureau sharing expenses.

The stallion Carmon is in excellent condition and his colts are developing well. This year the two 2-year-old sons of Carmon (Albion and Alva) are being used for breeding to a limited extent. In March, 1908, the purchasing board selected four mares in Kentucky to add to the stud. They were very fortunate in getting not only good individuals, but mares whose breeding has been proved to be probably the best for carriage purposes known in Kentucky.

On July 1, 1908, there were in the stud 1 aged stallion, two 2-year-old stallions, two 3-year-old geldings, four 2-year-old geldings, 22 aged mares, eight 2-year-old fillies, 5 yearling colts, 1 yearling gelding, 7 yearling fillies, 5 colt foals, and 6 filly foals.

During the year one mare died from a broken blood vessel, one yearling colt died from a blood clot in the heart, and one yearling filly and one yearling colt were destroyed on account of unsoundness.

Certain of the mares which have been found to be undesirable for further breeding will be culled out, and the board of survey is also expected to pass on the desirability of the retention of certain of the young stock.

VERMONT WORK.

The improvement of the Morgan horse farm at Middlebury has been carried on rapidly during the year. The house was thoroughly repaired and is now a creditable and very convenient farm house. Certain repairs have been made to the barn in the way of renovating the basement, putting in a concrete floor and new stalls, and improving ventilation. Considerable fencing was done during the year, but there is still a large amount to be done, and shelter must be provided to take care of the increase from the stud.

The stallion General Gates was purchased July 1, 1907, as indicated in the previous report, and at the same time the filly Ellen Gates was bought. Two mares were purchased in October—Marion Gates and Carrie Gates—both daughters of General Gates. Exhibits of horses from the farm were made at the Addison County Fair at Middlebury in August, 1907, and at the Vermont State Fair at White River Junction during the first week in October. They attracted a large amount of favorable attention.

The number of horses in the stud on July 1, 1908, was as follows: One aged stallion, 10 mares, two 3-year-old fillies, one 2-year-old filly, 5 yearling fillies, 1 yearling gelding, 2 colt foals, and 3 filly foals.

Losses during the year were one yearling filly from tetanus, and one mare and one yearling filly destroyed on account of unsoundness.

This work is being carried on in cooperation with the Vermont Experiment Station.

IOWA WORK.

The Iowa work in horse breeding, in cooperation with the Iowa Experiment Station, is an experiment to evolve a breed of American draft horses, using as foundation animals gray Shires and Clydesdales. The work was inaugurated during the summer of 1907, when eight horses (five Shires and three Clydesdales) were selected in Great Britain by Prof. W. J. Kennedy, of the experiment station. The Department at the time paid for three of the Shire mares and has since arranged to pay for all the horses of this importation.

Since their arrival at the station the horses have done very well, but no foals have yet been obtained. Five of them were exhibited successfully at the International Live Stock Exposition at Chicago in December, 1907. This season all of the mares have been bred to the Clydesdale stallion Kuroki.

The horses on hand on July 1, 1908, were as follows:

Clydesdales.

Kuroki 13214, foaled April, 1903, bred by John Young, Dalbeattie, Scotland.

Grey Pearl 13215, foaled April, 1902, bred by Thomas Gordon, Keith, Scotland.

Rose of Brownfield 13216, foaled May, 1899, bred by Major Bedford, Ecclefechan, Scotland.

Shires.

Dapple Tom 9137, foaled 1904, bred by John H. Marshall, Mamham Hall, Newark, England.

Madresfield Beckford 9141, foaled 1905, bred by Earl of Beauchamp, Malvern, England.

Madresfield Alice 9138, foaled 1904, bred by Earl of Beauchamp, Malvern, England.

Kirby Bedon Firefly 9140, foaled 1904, bred by Garrett Taylor, Monvich, England.

Burford Mettle 9139, foaled 1905, bred by Alexander McIntyre, Lymm, England.

CLASSIFICATION FOR AMERICAN CARRIAGE HORSES.

The steps taken during 1907 for the inauguration of a uniform classification for American carriage horses at State fairs were supplemented by a systematic campaign to put this classification into effect at State fairs generally in 1908. The efforts of the Bureau and the

American Association of Trotting Horse Breeders were highly successful, and twelve fairs adopted the classification in whole or in part for the 1908 season. In addition to these the Blue Grass Fair, held at Lexington, Ky., has adopted the classification used by it in 1907, which, although somewhat different in form from that recommended by the Bureau, is the same in purpose. At the fairs in 1907 where classifications were offered for American carriage horses, a Bureau representative was present and reported that in the main the showing was satisfactory. Although the exhibits were not all that could be desired, they were all that could be expected under the circumstances. At the Blue Grass Fair they were of a high order of excellence. The work of the present year will test this movement thoroughly, and every effort is being made to assist the fairs, in a legitimate way, to have successful exhibits. As was done last year, a representative of the Bureau will be present at each fair offering the classification.

At the annual meeting of the committee having this work in charge, held in Chicago November 18, 1907, the specifications were revised somewhat and the entire matter has been republished as Circular 113, revised.

SHEEP BREEDING.

During the past year the cooperative work at the Wyoming Experiment Station for developing a breed of range sheep has been progressing well. Owing to the very severe weather during the lambing season, a rather large number of lambs were lost. At shearing time 123 lambs were recorded, 57 ewe lambs and 66 ram lambs.

The 258 head of ewes averaged 10.5 pounds of wool, though a large number of them had only about a ten-months' fleece.

On July 1, 1908, there were 247 ewes, 123 lambs, and 6 rams in the flock; a total of 376.

BREEDING MILKING SHORTHORN CATTLE.

The work of breeding milking Shorthorn cattle has progressed slowly in Minnesota during the past year. Two meetings were held with the cooperators, and an organization was formed with a president and a secretary. An attempt was made to have listed and tested for tuberculosis all cattle intended to be in the experiment, and as a result of the tuberculin test two cooperators lost all stock entered, the presence of tuberculosis being shown. There are left in the cooperation only four herds, one of them being the herd of the university farm. These four herds promise well and should form a good foundation for future work. They comprise in all about 50 head of cows and 3 dairy-bred Shorthorn bulls.

Since the close of the fiscal year a circuit superintendent has been employed to give his entire time to the supervision of the herds and

to keeping the breeding and milking records. The plan is for the superintendent to make his headquarters at the Minnesota Experiment Station and visit each herd once a month, spending three days at each place. During this time it is planned to have him check up the records and advise owners in regard to the management of their herds, etc.

GENERAL ANIMAL BREEDING INVESTIGATIONS.

Certain experiments in animal breeding are being carried on by cooperation between the Animal Husbandry Office and the Bureau Experiment Station. This work includes the study of Mendelism with rats and the study of inbreeding and selection with guinea pigs. About 1,200 small mammals are being used in these experiments. No results have been obtained as yet which would warrant publication.

As a basis for the study of telegony, some white bull terriers have been purchased and will be bred pure six generations, after which time, if no evidence is present that the original dogs were not strictly pure bred, steps will be taken to test the question of telegony.

In June, 1908, one of the burros used in the zebra hybrid experiments gave birth to a foal by the President Grévy zebra Dan. Unfortunately, the little animal was exceedingly weak at birth and lived only a few days, although earnest efforts were made to save it. The carcass was sent to the Smithsonian Institution for mounting.

In April, 1908, two young female Grévy zebras were received direct from Abyssinia through the courtesy of Hon. R. P. Skinner, American consul-general at Marseille, France. They arrived in excellent condition, are quite easily handled, and one of them has been already bred to Dan. The Bureau now has one male and two female zebras [a] which are the Department's property.

ANIMAL NUTRITION INVESTIGATIONS.

The investigations in animal nutrition have, as in previous years, been carried on in cooperation with the Pennsylvania State College. Heretofore that cooperation has been specifically with the agricultural experiment station. On July 1, 1907, the work of the college in animal nutrition was reorganized as an independent department under the name of the Institute of Animal Nutrition, of which the former director of the experiment station was made director, and the cooperation of the Bureau during the past year has been with this institute.

During the year office and laboratory accommodations for the institute, connecting with the respiration calorimeter building, were

[a] One of the females has since died.

provided in the new agricultural building, the contract for the latter including also the principal permanent fixtures. At the same time a considerable amount of apparatus and several valuable sets of physiological journals, purchased during previous years for the work in animal nutrition, were transferred from the experiment station to the institute. The latter, therefore, began its independent existence with a fairly good equipment in addition to the respiration calorimeter and its accessories.

EXPERIMENTS IN BEEF PRODUCTION.

GENERAL.

The investigations in cooperation with the Missouri Agricultural Experiment Station may be divided for convenience into (1) winter-feeding experiments, and (2) full feeding of cattle on bluegrass pasture.

The winter-feeding experiments of 1907–8 were designed to determine (*a*) the economy of grain on cattle of different ages, and (*b*) the relative efficiency of corn and timothy hay, corn and clover hay, and corn, clover hay, and silage. Cattle of four ages were full fed during the winter. Fifteen cattle of each age were used, and those of each age were subdivided into three lots, one lot of each age receiving the same ration. It was thus possible to make a comparison of rations and also a comparison of the economy of beef production with cattle of different ages. The general plan of this investigation involved the feeding of the cattle of each age until they were finished for slaughter.

In the second investigation, during the summer of 1907, yearling and 2-year-old cattle were finished on bluegrass pasture. The investigation involved the comparison of rations composed of corn and linseed meal in varying proportions. These rations were fed to both yearling and 2-year-old cattle.

The investigations have yielded important results on the following factors in beef production:

1. The economy of gain as influenced by the age of the cattle.
2. The economic value of nitrogenous supplements to corn.
3. The best amounts of supplements to feed with corn.
4. The influence of condition on the economy of gains.
5. The economic value of silage for fattening cattle.
6. The comparison of different kinds of roughage for fattening cattle.
7. An economic comparison of full-feeding cattle in winter and summer on bluegrass pasture.
8. The length of time required to finish cattle.
9. The relative importance of the various factors such as season, ration, age, and kind of cattle on economic beef production.

SOUTHERN BEEF PRODUCTION.

The experiment with the herd of Mr. John S. Kernachan, of Florence, Ala., carried on as part of the cooperative work with the Alabama Experiment Station, with a view to showing what can be done under farming conditions to improve the native cattle for beef purposes, was brought to a close April 15, 1907, because of the discovery of tuberculosis in the herd. At that time the herd consisted of 70 head of grade Angus cattle. Fourteen steers were sold during the course of the year, directly off of the grass, at 3 cents a pound.

There had been from time to time an unusual number of deaths in the herd, which had been attributed to Texas fever, but the symptoms finally pointed to tuberculosis. A diseased organ of one of the cows was sent to Dr. C. A. Cary, of the Alabama Experiment Station, who pronounced the disease tuberculosis, and late in 1907 the tuberculin test was applied to the entire herd by Dr. D. C. Hanawalt, of the Bureau, with the assistance of Prof. Dan T. Gray, of the station, and 40 per cent of the cattle reacted. Mr. Kernachan is taking steps to eradicate the disease, with the assistance of the Quarantine Division of the Bureau. The results of the last year's work are being compiled for publication.

As a part of the cooperative work with the Alabama Station, feeding experiments are being carried on at the farm of Mr. O. E. Cobb, Sumterville, Ala. This work is under the supervision of Mr. W. F. Ward and involves two general problems: (1) To determine whether it would be a profitable thing to supplement the ranges as they are found in western Alabama and eastern Mississippi with a partial ration of hay or cotton-seed products in the winter time, and (2) to study the subject of finishing beef cattle on southern pastures, and at the same time to compare some of the cotton by-products as supplements to the pastures. The first part of the work was carried on during the winter, 81 steers being used. They were divided into three lots, one of which was given no feed except what could be obtained from the range; the second lot was fed, in addition, cotton-seed meal and hulls, and the third lot cowpea hay. The second part of the work was begun when the grass came in the spring and was still under way at the close of the fiscal year. Four lots of steers, aggregating 144 in number, were used. The results will be compiled later.

Plans are under way to enlarge the southern beef-production work by extending the investigations into other States in the South, preferably in tick-free territory.

FEEDING COTTON-SEED PRODUCTS TO HOGS.

The effect of fermented cotton-seed meal when fed to hogs was studied again in the summer of 1907 without any positive results.

The hogs were unthrifty, but none died, and it was impossible to tell whether the fermentation of the meal had any effect whatever. The experiment is being repeated. Next year it is expected to begin with feeding hogs on cotton-seed products in connection with alfalfa pasture.

INVESTIGATIONS OF ANIMAL FIBERS.

A study of animal fibers has been undertaken, and a collection of samples and fleeces of wool from different breeds of sheep and market grades and classes is being made. This work is expected to have an important practical bearing on the range sheep-breeding work in cooperation with the Wyoming Experiment Station.

POULTRY INVESTIGATIONS.

MAINE WORK.

The cooperative poultry work in connection with the Maine Agricultural Experiment Station, begun in 1904, has been continued during the past year. The experiment to determine the influence of floor-space allotment has been carried on for about four years, and as the results have been nearly uniform it has seemed unnecessary to continue the experiment beyond the current year (1908). The results of this experiment are being prepared for publication.

At the end of the current year there will also have been completed at the Maine station ten consecutive years' work in breeding for increased egg production. The results of this work show that for the entire period there has been no increase in average egg production, but rather a slight decrease. Therefore it has been deemed unwise to continue breeding by the same methods which have been followed in the past, namely, the selection of females on performance alone and of males on the performance of their dams. The future breeding work will be conducted in such a manner that both parents of the birds used will be known, and selection will be made accordingly. The records of the pullets will be kept in such fashion that the centgener power of each pair of parents will be known. The centgener power of the males used in breeding will be determined by using them in the breeding pens for at least two years. It is also proposed to introduce new blood into the barred Plymouth Rock stock of the station by putting into certain breeding pens cockerels from other high-laying strains of the barred Plymouth Rock. It is further planned to try in successive years new breeds of fowls, one each year. These will be bred pure and also crossed on the barred Plymouth Rock stock of the station. Any pure breed or hybrid showing up well will be retained and bred further.

Experiments are also planned to investigate the influence of external conditions, particularly feeding, upon egg production. At first

this will be largely confined to the influence of the amount and kind of protein in the ration.

INDEPENDENT POULTRY WORK OF THE BUREAU.

On January 1, 1908, a new line of investigation was taken up in the study of the conditions surrounding the production, transportation, and marketing of eggs, with a view of determining some of the causes of deterioration in quality and consequent loss in value. With this object in mind, a careful preliminary field study of the conditions throughout the great area of the Mississippi Valley and the South has been made, and it is intended to follow this by a study of the large eastern markets. It is believed that information is being obtained which will be of much value in pointing out means for bettering the quality of the southern and western eggs shipped to the East and of saving a considerable unnecessary loss to the producers.

Mr. Milo M. Hastings, who is making these studies, while working in the cold-storage rooms of some of the large Chicago cold-storage plants, observed that the instruments used for determining and regulating the moisture in these rooms were far from satisfactory. As the control of moisture is one of the most important factors in the proper cold storage of eggs, he set to work on this problem, and has devised an instrument termed a cold-storage evaporimeter, which shows automatically whether the moisture in the air is below or above the amount desired. This instrument has been tested in some of the largest cold-storage houses in Chicago and has proven satisfactory. It is not only suitable for indicating the moisture of egg rooms, but also for any location where the temperature is held constant. The Department has already made application for a patent on this device, so that the same may be used free of royalty by persons in the United States, and a description of the instrument has been prepared for publication as a circular of the Bureau.

During the past year the investigations with poultry, begun in 1906 at the quarantine station of the Bureau at Halethorp, Md., have been continued at the new location at the Bureau Experiment Station, Bethesda, Md. The present equipment consists of a laying house 16 by 80 feet, divided into five pens, with a small feed house attached; five colony houses, each 7 by 12 feet; four smaller colony houses; a laying house, 12 by 36 feet; an incubator house, with a capacity of seven 240-egg incubators; a small building used as a cook room, office, and quarters for the attendant, and a number of outdoor brooders. The area used for the poultry consists of about 5 acres, fenced with 6-foot woven-wire fencing.

The experimental work to compare the moist mash, dry mash, and hopper methods of feeding laying hens has been continued during the past year. The yearling hens are being carried through their second

year by these methods, while pens of pullets hatched from these hens are being fed in the same manner to determine the effect, if any, upon vigor and vitality. It is planned to continue this investigation two or three generations further.

During the year about 20 capons have been fed in comparison with the same number of cockerels. About 30 cockerels were fed on a ration containing a small amount of cotton-seed meal in comparison with a similar lot fed with linseed meal in place of cotton-seed meal. It is planned to repeat both of these feed trials with the present growing stock.

SUPERVISION OF PEDIGREE RECORD ASSOCIATIONS.

The system of supervising pedigree record associations which went into effect July 1, 1906, continues to work smoothly and successfully. The secretaries almost without exception have adopted the form of entry certificate prescribed by the Treasury Department for the importation of purebred animals free of duty, and delays at the port of entry have been avoided. The regulations of the Secretary of Agriculture (B. A. I. Order 136) for the certification of pedigree record associations have been amended so as to render a certified American association liable to withdrawal of certification in case imported animals which are registered to obtain the duty-free privilege are not first registered by one of the foreign affiliated associations for the breed. This amendment was necessary because, owing to a misunderstanding of the intent of the regulations, a few American secretaries registered imported animals which had not first been registered in the certified foreign association for the breed. Three additional associations were certified during the fiscal year, making a total of 135, of which 70 are American and 65 foreign.

In the fall of 1907 a Bureau representative made an investigation of all the American pedigree record associations certified by the Department, and found that with few exceptions their work was being very well conducted.

The authority under which the Department acts in supervising pedigree record associations is that conferred by paragraph 437 of the tariff act of July 24, 1897 (as amended March 3, 1903), which reads as follows:

Any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free, whether intended to be so used by the importer himself or for sale for such purpose: *Provided,* That no such animal shall be admitted free unless pure bred, of a recognized breed, and duly registered in the books of record established for that breed: *And provided further,* That certificate of such record and of the pedigree of such animal shall be produced and submitted to the customs officer, duly authenticated by the proper custodian of such book of record, together with the affidavit of the owner, agent, or importer that such animal is the identical animal described in said certificate of

record and pedigree: *And provided further*, That the Secretary of Agriculture shall determine and certify to the Secretary of the Treasury what are recognized breeds and purebred animals under the provisions of this paragraph. The Secretary of the Treasury may prescribe such additional regulations as may be required for the strict enforcement of this provision. Cattle, horses, sheep, or other domestic animals straying across the boundary line into any foreign country, or driven across such boundary line by the owner for temporary pasturage purposes only, together with their offspring, may be brought back to the United States within six months free of duty, under regulations to be prescribed by the Secretary of the Treasury: *And provided further*, That the provisions of this act shall apply to all such animals as have been imported and are in quarantine or otherwise in the custody of the customs or other officers of the United States at the date of the passage of this act.

The purpose of this act was primarily to protect the United States against frauds in importations, and to protect breeders of the United States against inferior animals which could be imported readily duty free unless some restrictions regarding pedigree were provided. The Treasury Department has so framed its regulations that registration in a certified American book of record is necessary in practically all cases before the importation of animals duty free for breeding purposes is permitted.

Although the operations of the law now in force have to do strictly with nothing but the importation of breeding animals, the breeders of the country have come to regard the certification of the Department of Agriculture as a safeguard and a guaranty that the association so certified is doing a legitimate business. In the public opinion the prestige gained by the Department's certification is of far more importance than any other consideration. In the States of Iowa, Minnesota, Pennsylvania, Utah, and Wisconsin legislation has been enacted which requires stallions standing for public service to be registered with the State authorities and duly licensed as purebred or grade. In determining what stallion should be licensed as purebred, registration in an American stud book certified by the Department is a prerequisite. It is also a common practice at stock shows to make a similar requirement for animals shown in the breeding classes.

That the rather close supervision which the Bureau now exercises over certified American associations has resulted beneficially there is little reason to doubt. However, it is rather anomalous that a law intended to guide customs officers in deciding what animals shall be imported free for breeding purposes should in its operation be so changed in effect that it is of much more importance to the country as a measure for the supervision of local record associations. This condition makes the administration of the law, as it relates to this Department, rather difficult. Moreover, there is nothing in the law which protects the American breeder against fraudulent registry associations. If some of the associations now certified should see fit

to refuse to comply with the Department's regulations they could still continue their business, and might in time overcome the loss of prestige resulting therefrom. Furthermore, should the tariff be revised in such a way as to place a duty on breeding animals there would be no further excuse for the Department's supervision, and there would be no safeguard to the small breeder except such as might be furnished by State laws, which would result at best in a very unfortunate lack of uniformity.

At present there are several associations of considerable prominence, none of which are registering stock which is really purebred and none of which are certified, but all of which are doing business over a considerable extent of the country. They cater to the beginner, the poorly informed breeder, who usually needs protection most and can least afford to lose money on account of poor pedigree certificates. Such a man does not as a rule know what constitutes the difference between a certified and an uncertified association; yet when he buys an animal registered by one of the uncertified associations referred to its transfer as a purebred animal is as a rule impossible. At best, registration in an uncertified association is a waste of money.

To remedy this state of affairs it is recommended that Congress be asked to enact legislation providing that no person or association of persons shall be permitted to engage in the interstate business of recording or registering pedigrees of domestic animals without having first obtained the certification of the Secretary of Agriculture, and that the Secretary of Agriculture be empowered to make and enforce such regulations as may be needed to carry out the provisions of the law. Although the mere failure to obtain or keep such certification would be sufficient to keep illegitimate associations out of interstate business, there should be ample penalties for the punishment of persons who violate the law.

THE DAIRY DIVISION.

The work of the Dairy Division, under Mr. Ed. H. Webster, chief, is organized in sections dealing, respectively, with (1) dairy farming investigations, (2) dairy products investigations, (3) dairy manufacturing investigations, (4) market milk investigations, and (5) renovated butter inspection. The specific lines of work carried on may be summarized as follows:

1. (*a*) Work in the interest of southern dairying; educational in character, conducted throughout the Southern States; intended for the development of the dairy industry in that section.

(*b*) Herd record work, comprising a study of the performance records of dairy cows, and ways and means whereby farmers may be interested in keeping such records.

(c) Dairy building investigations, which consist in devising plans, as simple as may be, for the construction of barns, silos, dairy houses, creameries, and cheese factories, including an extensive study of the subject of barn ventilation.

2. (a) Investigations in the manufacture and storage of butter, with special reference to its keeping quality.

(b) Investigations in the manufacture of the Swiss type of cheese; a fundamental study of the principles involved in the manufacture and curing of cheese.

(c) Investigations in the manufacture of the Cheddar type of cheese, supplanting the development of lactic acid by the use of mineral acids in the process of making.

(d) Studies in the manufacture of the Camembert, Roquefort, and other types of soft cheeses, their adaptability to American conditions, and the possibility of their manufacture in this country.

(e) An extended study of the problem of milk secretion, including an investigation of the effect of period of lactation, of the breed of the animal, of climatic conditions, and of different feeds, upon the quality, both physical and chemical, of the milk.

3. (a) Investigations in creamery methods and practice.

(b) Investigations in cheese factory methods and practice.

(c) Investigations of the principal markets where butter is sold as to market conditions, quality of butter, and causes of defects found in butter.

(d) Investigations into the conditions existing in cream-shipping territory—that is, where cream is shipped by rail to distant points for manufacture into butter, including such questions as the factors that affect the quality, the price received by the farmer as paid by the creamery, and a general observation of results obtained over the entire territory where such conditions exist.

4. (a) Investigations of the handling and distribution of milk intended for market purposes, with special reference to methods of inspection that may be adopted by boards of health or other officials.

(b) Investigations in regard to the farm methods necessary for the production of milk intended for market purposes, so that it will reach a good standard of wholesomeness and meet the requirements of city ordinances.

5. Inspection of renovated-butter factories and markets and certification of renovated butter for export.

In addition, the Dairy Division cooperates with the officials of the National Dairy Show Association in so far as such cooperation will assist in developing the educational features of their annual show. It also sends representatives to dairy conventions, both State and

National, so far as practicable, for the purposes of assisting in their work and gaining information of use in the work of the division. Dairy literature is indexed and classified and information is disseminated by means of publications and correspondence.

It is the policy of the Dairy Division to encourage State officials to carry on work for the benefit of the dairy interests in their respective States. The division does not wish to continue indefinitely work which the States can and should do for themselves. While it is sometimes desirable, as in the case of the southern dairy work, for the division to begin work of an educational character and to make a study of conditions and needs, the policy is to induce the State authorities to take up and continue the work and allow the Department gradually to withdraw.

DAIRY FARMING INVESTIGATIONS.

The work of this section is in charge of Mr. B. H. Rawl.

SOUTHERN DAIRYING.

Ten men have been employed during the past year in the work for the development of dairying in the South. While it is intended that the field men should give all assistance possible to the dairymen with whom they come in contact, provided the dairymen are in a position to be assisted, still it is realized that it is best not to attempt to get a farmer to adopt too many new things at one time; hence one or two things that are most essential are taken up first, and when results have been obtained with these and the farmer's confidence won, other things are recommended. Since two of the greatest drawbacks of southern dairymen are the lack of a sufficient number of good cows and the lack of suitable buildings (barns, silos, dairy houses, etc.) for handling in the best and most economical manner the cows and their products, the greater part of the attention of the field men has been devoted to herd testing and buildings. This work has been the means of making many unprofitable dairies profitable.

Herd testing.—During the year this work was begun with 116 herds, containing 3,921 cows. Of these herds 43, containing 1,428 cows, were discarded before the work had been in progress very long because of the indifference of the owners, and with 84 herds, containing 2,493 cows, the work has been successfully conducted. As soon as good results are obtained the owner usually purchases a purebred bull for his herd unless he already has one; therefore practically all of the 84 herds mentioned are headed by purebred bulls.

As an example of what is being accomplished, the following table has been compiled, showing the results of twelve months' records kept of 719 cows in small herds located in various parts of the South.

Summary of records of different classes of cows based on butterfat production for one year.

Items.	Average of 719 cows.	Best cow.	Poorest cow.	Average of best 10 cows.	Average of poorest 10 cows.	Average of best 30 cows.	Average of poorest 30 cows.
Milk produced.........pounds..	4,299.4	8,325.5	1,125.0	8,681.9	1,577.6	7,326.0	2,099.6
Butterfat produced....pounds..	216.84	538.79	64.12	459.0	77.21	391.75	100.7
Value of butterfat at 28 cents a pound..........................	$60.71	$150.86	$17.95	$128.52	$21.62	$109.69	$28.20
Value of skim milk at 20 cents a hundredweight................	$8.17	$15.57	$2.12	$16.45	$3.00	$13.87	$4.00
Total value of products.........	$68.88	$166.43	$20.07	$144.97	$24.62	$123.56	$32.20
Cost of feed per cow............	$36.27	$72.03	$23.80	$65.73	$24.63	$54.83	$27.36
Profit [a] per cow................	$32.61	$94.40	−$3.73	$79.24	−$0.01	$68.73	$4.84
Cost of producing 1 pound butterfat..................cents..	16.7	13.4	37.1	14.3	31.9	14.0	27.2
Returns for each $1 invested in feed..........................	$1.90	$2.31	$0.84	$2.20	$1.00	$2.25	$1.18
Profit [a] on each $1 invested in feed..........................	$0.90	$1.31	−$0.16	$1.20	$0.00	$1.25	$0.18

[a] Profit as here used means simply gross returns less the cost of feed; other elements of cost are not considered.

The valuation of butterfat in the foregoing table (28 cents a pound) is based on the average price quoted in the New York market for butter for the past twelve months. Much of the product of these herds sold for a higher price, but in order to put all the cows on a comparable basis, and also that these results may be comparable with similar results from other sections of the country, this valuation is used and is considered fair.

The cost of feed consumed by the best cows was in all cases too high, showing that sufficient attention is not given to home-grown feed.

While the cost of producing a pound of butterfat is higher than it should be if the most economical methods of feeding were used, still it is only 13.4 cents a pound with the highest producing cow, while it is 37.1 cents a pound with the one that produces the least. This suggests a question that should be considered by the dairyman: How can he afford to keep cows that produce butterfat at a cost of 37.1 cents a pound which must sell at from 28 to 30 cents a pound?

Furthermore, these facts show that the idea so prevalent among southern farmers that cattle do not produce well in that section is incorrect, and that profit in that section, as elsewhere, depends on the quality of the cattle and the methods of handling them.

Another important consideration in connection with the facts above given is that the work of herd testing is done not primarily to secure this information, but in order that the owner of the cattle may be taught the enormous difference in the producing qualities of cattle, and hence improve his herd by getting rid of the inferior ones. Within two months after the testing is begun with a herd the owner usually begins to cull out the poorest cows. As the figures given in the table show only the results from animals of which a year's record

was obtained, it is evident that many of the most inferior cows in the herd tested are not included in these records.

Numerous letters attesting the practical value and results of this work of herd testing have been received. A Louisiana dairyman writes:

As a result of the facts obtained in carrying out this idea I reduced my herd 30 per cent, and yet increased the production 15 per cent. The saving of feed and labor with the lesser but more profitable herd was large, reversing the business from a questionable financial venture to a decidedly profitable one.

A Georgia farmer says:

It took nearly a year to convince us that some of our favorite cows were losing us money, but as soon as this was found out they were disposed of. The first winter we milked 20 cows most of the time and shipped an average of 100 pounds of butter per week. The second winter we milked 12 to 14 cows and shipped an average of 99 pounds per week. The difference was due to the silo, scales, and Babcock test. I thought all our cows were about the same until the record was kept and tests made.

Dairy buildings.—During the fiscal year 45 silos were built by farmers and dairymen under the supervision of the Dairy Division, and after plans furnished by it, and 112 more were proposed and in process of construction in the summer of 1908. There were also completed during the fiscal year 24 barns, and 28 were proposed for construction during the summer and fall. Five dairy houses were built and a large number remodeled.

City milk supplies.—Systematic work has been conducted in nine southern cities with the object of assisting the cities to establish such systems of inspection and control of their milk supplies as will safeguard the public against danger, but will not work a hardship on the honest dairymen who are producing a safe product. Some of the cities with which this work has been done have adopted the Dairy Division score-card system and have made material advancement.

Creameries.—Assistance has also been given in organizing a few creameries. Two new creameries have been built in Texas with the advisory assistance of the Dairy Division, and some work has been done with creameries that are in operation in Tennessee and Kentucky. As a rule the dairy industry is not sufficiently developed in the South to warrant the establishment of creameries, and the Dairy Division endeavors to discourage the building and selling of creameries by promoters in communities where sufficient milk is not being produced to justify their operation.

Organization, cooperation, etc.—When the field work was begun by the Dairy Division in the Southern States there was practically no organization of the dairy interests. Recognizing the great importance of organization which would not only support the work but furnish a means of utilizing its results to the best advantage, considerable attention has been given to this subject. Some of the State

organizations that were in existence prior to this work have been revived and made active. One State and several county associations have been organized, and others have been planned. The field men in every State take very active part in the work of all dairy organizations. With the development of the dairy industry it is expected that such organizations will bring about the creation of State dairy departments and will be the means of obtaining support for the continuance and development of the very work that the Dairy Division has begun.

It is most gratifying to report that the cooperation with State institutions has, on the whole, been very satisfactory. The cooperating institutions have appreciated the value of the work, have encouraged it, and assisted in every way that their facilities would permit. They have had but little money available for such work, but they have foreseen that this field work will most assuredly establish a dairy industry in that section, and that as results increase the farmers will become interested and will provide facilities for continuing it. Because of the interest which has been created purely by the work of the Dairy Division, the North Carolina department of agriculture and the Mississippi Agricultural College have recently supplied, at their expense, assistants for this work, and it is quite probable these States will increase their support as further results are produced and will eventually take over the entire work. Louisiana also provided an assistant for that State during the past year, and his time was largely taken up with experimental work, which is hereinafter reported. The Georgia Experiment Station has provided $600 for dairy field work in that State during 1909. Other States will doubtless follow the examples of those above mentioned. The fact that men are being appointed by State institutions to give their entire time to the work of visiting the dairymen and teaching them is a strong indication of the great and far-reaching effect of the work that the National Department of Agriculture has been conducting in that section for the past three years.

In Mississippi and Georgia publications have been issued by the experiment stations giving the results of the work done by the field men. The North Carolina department of agriculture also has one in course of preparation. These local institutions are encouraged to issue publications from time to time, so that the people of the States in which the work is in progress will get the use of its results.

More than 80 agricultural meetings have been attended by the field workers during the past fiscal year. Assistance is given in conducting the short courses in dairying at the agricultural colleges in all States where such assistance is needed. In a number of States considerable work has been done in connection with State fairs, and some of the fairs are now making their dairy departments quite prominent.

Feeding experiments.—An experiment in feeding calves with blackstrap molasses, conducted in cooperation with the Louisiana Experiment Station, has been completed, and the results have been published in Bulletin 104 of that station. Since the results were entirely negative, they were considered of little value to persons outside of the section where blackstrap is produced; hence no publication on the subject was issued by the Dairy Division.

In view of the possibility of the cold-pressing process for extracting cotton-seed oil coming into use, an experiment to determine the feeding value of the cake resulting from this process as compared with the meal and hulls from the ordinary process has been conducted in cooperation with the Louisiana Experiment Station. The cold process differs from the ordinary process in that the hulls are not removed and the "meats" are not heated, the resulting cake containing both the meal and the hulls of the seed. The only reason to suppose that the cold-pressed products would differ in feed value from an equal amount of meal and hulls was that the heating in the ordinary process might affect the digestibility of the meal. The results of the experiment show that if there is any advantage in favor of the cold process it is so small as not to be worthy of consideration in ordinary operation.

HERD RECORD WORK.

Two principal lines of work now under way to promote the keeping of records of dairy herds are the establishment of an advanced register of merit for recording the performances of all purebred dairy cows on the basis of yearly records as authenticated by the officers of experiment stations, and the organization of cow-testing associations or organizations intended to encourage the farmer to keep accurate records of his dairy operations.

For the purpose of working out systems of herd testing that are best suited to various conditions, one man was appointed May 1, 1908. These systems will be applied under the supervision of the Dairy Division until they are thoroughly tested, and those that prove satisfactory will be made available to communities where testing associations are being organized. Assistance will be given in organizing herd-testing associations only in cooperation with some State institution, the object being to assist the State institution so that it may eventually continue the work independently.

DAIRY BUILDING INVESTIGATIONS.

Silo experiments.—Since the silo investigations were begun in connection with the southern dairy work it has been realized that the available data on the pressure of silage were insufficient, if not un-

reliable. A special dynamometer for measuring silage pressure has therefore been designed and is being made. If, after testing this machine, it is found satisfactory, arrangements will be made to go into the question thoroughly during the coming year.

Two silos have been built of cement and metal in order to test that kind of construction.

Stable ventilation.—There is much difference of opinion as to the effectiveness of the different systems of barn ventilation. During the winter of 1907–8 an experiment was conducted for the purpose of making a comparison of all the principal systems so as to determine the efficiency of each. A barn for this work was provided by Mr. H. McK. Twombly, of Madison, N. J., and more than 1,700 tests were made for carbon dioxid, moisture, and temperature. Another winter at least will be required to complete this experiment. While no general conclusions can yet be drawn, the results so far obtained indicate very strongly that some of the principles of ventilation that have been accepted in the past are entirely wrong.

DAIRY PRODUCTS INVESTIGATIONS.

This work is in charge of Mr. L. A. Rogers, and a considerable part of it is carried on in cooperation with State experiment stations, because of lack of proper facilities to do the work in or near Washington.

BUTTER INVESTIGATIONS.

Fishy flavor.—The investigations to determine the cause of the so-called fishy flavor of butter have been continued. The factors ordinarily connected with this trouble have been eliminated as possible causes, but further investigation will be necessary to determine the actual cause. While acid appears to be essential to the production of this flavor, it does not seem to be the controlling factor. Certain results have indicated that the controlling factor is the treatment of the butter in the churn, but this point has not been clearly demonstrated.

Butter from sweet and sour cream.—It has been demonstrated that butter of superior keeping quality may be made from cream properly pasteurized and cooled and churned without the addition of a starter. This has been shown with butter made and stored under both experimental and commercial conditions. The difference between butter made in this way and ordinary ripened butter is especially noticeable at the higher storage temperatures.

It has also been demonstrated that the keeping quality of storage butter made from pasteurized cream is in a general way in an inverse ratio to the amount of acidity developed in the cream.

Classification and study of lactic-acid bacteria.—A study has been made of the value of cultural and other characteristics used in classifying this group of bacteria. A large number of cultures have been obtained from various sources and grouped on the basis of fermentation of sugars. The permanency and value of these groups in describing lactic-acid forming bacteria are being determined.

A number of species and varieties of bacteria capable of forming acid from milk sugar and digesting casein have been collected from various parts of the country. This group of bacteria is widely distributed and is usually very abundant in cream which has been improperly cared for. They belong to the lactic-acid group and are able to live under conditions which exclude most bacteria. The morphology, physiology, and cultural characteristics of these bacteria have been studied with a view to their proper classification, and the rate and extent of growth in competition with nonliquefying lactic-acid bacteria have been determined. The nature of the enzymes secreted and their influence on the flavor of butter have been studied. It has been found that the growth of these bacteria in cream has a deleterious effect on the quality of the butter.

Cultures for making starters for butter making.—Work has been started in investigating the possibility of making dried cultures of superior vitality by using a new process of drying milk. It has been found that partially soured milk dried by this process contained after three years sufficient bacteria to develop acidity rapidly when the necessary water was supplied. It has also been found that by properly neutralizing the acidity produced by the growth of lactic-acid bacteria a maximum number of bacteria may be obtained three or four times greater than the usual maximum reached in the ordinary souring of milk. It is hoped that by combining this principle with the special method for drying cultures a culture may be obtained at a low cost which will retain its activity for a long period and will produce a mother starter of more than the ordinary vitality.

CHEESE INVESTIGATIONS.

Cheddar experiments.—The cooperative experiments in making Cheddar cheese inaugurated two years ago by the United States Department of Agriculture and the Wisconsin Agricultural Experiment Station at Madison, Wis., have been devoted to the problem of substituting commercial acids for the biological lactic acid developed during the process of manufacture. The first year (1906–7) was mostly given to experiments for determining the kind and amount of acid best suited for the purpose and to testing methods of manufacture applicable to the new system. During this time a method for adding acid to milk without producing coagulation was devised and several hundred cheeses were made with seven different acids.

Some of these cheeses were of excellent quality, but most were deficient either in flavor or texture, the texture being more frequently at fault. The most promising results were obtained with hydrochloric and phosphoric acids, and accordingly these acids were selected for further trial.

With each of these acids great improvement has resulted in both texture and flavor, which has been maintained throughout the life of the cheese. The average scores of all cheeses made with commercial acids during February, March, and April, 1908, have been a trifle higher than the scores of control cheeses made from the same milk with a lactic-acid starter. A duplicate set of these cheeses was placed in cold storage at 34° F. immediately after being paraffined, and will be kept under conditions which conform to the best practice. This should furnish a more satisfactory test of the process than is afforded by cheeses cured at higher temperatures in the university rooms.

Owing to scarcity of milk it has been impossible to test commercial acids on a factory scale at the university, and accordingly arrangements were made for this work at a factory owned by Mr. H. J. Noyes, Muscoda, Wis. Cheese was made at this factory during two weeks in May, 2,500 pounds of milk being used daily. All of the cheeses obtained, together with check cheeses made in the ordinary manner from the same milk, were put in cold storage for comparison.

In practically all experiments there has been less fat lost in the whey and an increased yield of cheese when commercial acid was used, as compared with results of the ordinary method. The increase in yield has been from 1 to 5 per cent, and is considerably more than sufficient to pay for the acid used.

During the past winter a few pasteurized cheeses were made with the addition of commercial acid, and these proved to be of exceptionally good quality. The importance of this line of work warrants more extended experiments next year.

Soft-cheese investigations.—The investigations in the manufacture of the Camembert and Roquefort types of cheese have been continued at Storrs, Conn., in cooperation with the Storrs Experiment Station.

The work of the past year with regard to the Camembert type indicates that a temperature of 65° F. in the making room is warm enough to induce proper drainage. At this temperature normal souring goes on, while the development of gas is much restrained. These results agree with the best usage observed in the factories making this cheese.

In our previous work new milk was used, and such milk obtained with special care was prescribed in a published report. Experiments have been made in using milk from the ordinary farm twenty-four to thirty-six hours old, and from the college herd twelve hours, twenty-four hours, and thirty-six hours old, with and without refrigerator cooling, as well as fresh milk cooled. The present indications are

that milk drawn with reasonable care and held for twelve to twenty-four hours works up as well as or better than entirely fresh milk, so long as acidity has not begun to develop to an appreciable extent when the milk is received. The unripe part of imported Camembert cheese is very sour. Such acidity seems to be more uniformly obtained in milk which has been held overnight at least. Further investigations on this point will be made.

Experiments have indicated that the temperature of the ripening room should be lower than that heretofore recommended, and that the room must be kept moist and the period extended to four or five weeks. So far results indicate that the best-flavored cheeses are obtained by the use of this longer period. Further experiments are desired to establish definitely what period and what temperature are best.

Recent work has proved the presence of yeasts in both imported and domestic cheese of the Camembert variety. There is some reason to regard these organisms as the cause of much gassy curd. This problem is so far practically untouched.

Cheeses of the Roquefort type have been made regularly and ripened in various ways with very uncertain results, which have sometimes been very encouraging, but have involved many complete failures. Experiments are being continued with a view to overcoming the difficulty encountered in producing the ideal open, crumbly texture.

In connection with the study of the molds concerned in the ripening of soft cheese, the mycologist engaged in this work, Dr. Charles Thom, has prepared an extensive technical treatise dealing with species of Penicillium.

The chemical work, carried on by Mr. Arthur W. Dox, has consisted in studies of the proteolytic products occurring in the ripened cheese and of the enzyms produced by the molds. Many of the chemical constituents of the Camembert type of cheese have been isolated and identified, and the absence of typical putrefactive products has been demonstrated. A paper entitled "Proteolytic Changes in the Ripening of Camembert Cheese" has been prepared for publication as Bulletin 109 of the Bureau of Animal Industry. As a logical sequel to the work reported in that bulletin, new investigations have been instituted to determine the chemical nature of the factors that cause the ripening of the cheese.

Swiss-cheese investigations.—This work, which is carried on at Albert Lea, Minn., in cooperation with the Minnesota Experiment Station, is in charge of Mr. C. F. Doane and Mr. T. W. Issajeff. In connection with the laboratory plant used for butter investigations at Albert Lea, there has been constructed a curing room for cheese. Space has been secured in the creamery plant for the manufacture of

the Swiss type of cheese, and milk is purchased from the Albert Lea Dairy Association for this purpose.

The fundamental problems involved in the manufacture of Swiss cheese are but little understood; the whole process seems to be one of "rule of thumb" rather than any scientific method. Makers of the Swiss type of cheese in this country, as well as in Europe, follow the plan which has been in vogue for a great many years in Switzerland and Germany. This method is open to many objections, as it is almost impossible to get a uniform product with any degree of certainty, and the losses sustained in the making through the loss of butterfat in the whey are enormous. The physical and biochemic theories of ripening have not been studied to any extent in this country or abroad. This is a large and important field of investigation. The facilities for this work at Albert Lea have been materially improved and enlarged during the past year, and good progress has been made in determining some of the fundamental problems.

MILK SECRETION INVESTIGATIONS.

The investigations to determine various facts regarding the process of milk secretion and the changes in the composition of milk because of different conditions of breed, feed, lactation period, etc., have been continued in cooperation with the Missouri Experiment Station. Several years will be required for carrying out these investigations, and certain preliminary studies have been found necessary before attacking the main problems. A report of some of this preliminary work, in the nature of a chemical and physical study of the large and small fat globules in cows' milk, by R. H. Shaw and C. H. Eckles, has been prepared for publication as Bulletin 111 of the Bureau. During the fiscal year the effect of the period of lactation on the composition and properties of milk has been studied. It is proposed to take up next the effect of certain feeds, particularly cotton-seed meal, on the milk. These investigations involve a vast amount of tedious routine work, including an immense number of chemical analyses.

MARKET MILK INVESTIGATIONS.

The work of this section during the past year, in charge of Mr. C. B. Lane, assistant chief of the Dairy Division, has been largely along educational lines, such as giving assistance to city boards of health and to dairy farmers, by personal visits, public lectures, and milk contests; in fact, a general campaign has been conducted for the improvement of market milk and the development of the dairy interests of the country.

Mr. Lane and his assistants personally visited 125 cities during the year, usually at the request of the health officers for assistance in im-

proving the milk supply. The general plan has been for a representative of the division to visit a city, consult with the health officer and in some instances with the board of health and the city council jointly, and discuss the milk ordinances in force and suggest improvements; to advertise in the local papers a general public meeting for dairymen, consumers, and physicians, and at such meeting to discuss the milk question in a comprehensive way. The score-card system is explained and general information is given as may be needed. Special meetings are frequently held with dairymen and physicians to discuss dairy matters from their particular standpoints. One or more days are usually spent with the city inspector in personally visiting and scoring dairies with him and giving him all the assistance possible in introducing the scoring system. The Dairy Division score card, or a slight modification of it, has been adopted or used by city or State officials, creameries, dealers, etc., in 61 cities, while 79 other cities have been given assistance through correspondence or visits by the inspectors, making a total of 140 cities, located in 24 States, the District of Columbia, and Canada, that have been given more or less assistance during the year. A number of cities have made marked improvement in the condition of the dairies supplying milk; for example, one increased the average score of the dairies from 41.5 to 72 points in a year.

In connection with this work of improving the milk supply, representatives of the Dairy Division have attended and taken part in 82 public meetings held in 55 cities in 24 States. The division has also assisted materially in holding five milk contests.

No attempt has been made to visit all of the dairy farms supplying milk to any city. However, 206 dairies with 8,527 cows have been inspected by members of the Dairy Division staff in connection with the work of improving the milk supply of cities. These were located in 50 cities and towns in 16 States. The average score of these dairies was 51.05 on a scale of 100. The average score for equipment was 60.28 and for methods 46.04. This indicates very clearly that it is not so much better equipment that is needed as better methods. The average rating of 1,000 dairies inspected in Maryland, Virginia, and the District of Columbia during the past two years was 45.41.

Reports have been received on about 10,000 dairies that were rated by officials and persons outside of the Dairy Division by the use of the score card, and the average score of these dairies was about 52.5.

In the spring of 1908 an inspector was assigned to a special investigation relative to the best methods of producing and handling milk on dairy farms.

One man spent six months at the Jamestown Exposition demonstrating methods of handling milk.

DAIRY MANUFACTURES.

The work of the section of dairy manufactures, which is in charge of Mr. B. D. White, relates to the business operations of butter and cheese factories and the commercial problems of manufacture and distribution. Branch offices are maintained at New York City, Chicago, and San Francisco, with experts in these subjects in charge. These officers carry on correspondence with butter makers, creamery superintendents, and creamery managers in regard to the commercial quality of butter received in these respective markets. They examine this butter either on request from the creamery shipping it or on request of the buyer. In either case the inspector goes to the store when the butter is received, takes samples for analysis, examines it for defects in quality, and reports his findings, with the analysis, to the creamery, the purchaser, the dairy and food department of the State where the creamery is located, and to the Washington office of the Dairy Division.

The New York office during the year made 700 inspections, and since the beginning of this work has examined the product of 360 creameries. Regular inspections are being made for about one-third of the butter commission firms in New York City and occasional inspections for other firms. The Chicago office inspected 1,230 lots of butter and has examined the product of 877 creameries since this work was undertaken, 352 new creameries having been added to the list during the fiscal year.

This work is undoubtedly of much practical value to the creameries and dealers, and it is growing in favor with those interests. The principal objects are to improve the quality of butter and to assist creameries in overcoming conditions causing poor quality.

There seems to be more of a disposition on the part of the creameries in general to consider the inspector's suggestions in the light of their possible helpfulness in improving the quality of their butter rather than to regard them as critical fault-finding. As the creameries have become more familiar with the work they have come to understand that the inspection of their butter is both a help and a protection, and are accordingly showing much more interest in it. As the butter dealers have found that the creameries are willing to accept the inspectors' reports in the proper spirit they have made more use of the inspection.

While there are many creameries that have been helped to improve the quality of their butter, there are many others which have made no improvement because the character of the cream which they were receiving was such that it was impossible for them to make a better grade of butter. A close study of the butter as it comes to the market shows plainly that the average quality is poorer than in past years.

This is due largely to the way the cream is handled on the farm and the length of time it is held. With the introduction of the hand separator the farmer has found that he can keep the cream longer on the farm and take less care of it, and still find a market for it, and he has taken advantage of this to the limit. At first the local creameries refused to take this poor cream, but they soon found that if they did not take it the so-called "centralizer creameries" would. Many creamery managers say they know they are taking cream which is unfit for butter making, but that they are forced to do this by the competition of the centralizers. A few creameries that have been able to hold their patrons and force the delivery of fresh cream have, with the aid of improved machinery and methods, made a better and more uniform quality of butter. Many of the creameries handling this poor cream are using pasteurizers and other up-to-date machinery, but the quality of their cream is so poor that the improved methods do not make any appreciable improvement in the quality of their product.

Moisture is another factor which has much to do with the quality of butter. As competition becomes stronger and many of the creameries are unable to improve the quality of their butter, they are trying to make a gain by incorporating moisture up to the limit allowed by law. Unfortunately, very few butter makers are posted on the proper methods of incorporating moisture. Many are using methods which are very seriously injuring the texture, and consequently lowering the quality of their butter.

For some time past there has been too little difference in market prices for various grades of butter. During the summer there was a difference of only 4 or 5 cents a pound between the fancy grades and butter that was so poor as to be unfit for table use. The large amount of poor butter which is being made is having a very injurious effect on the butter market. Consumers may be forced to eat a butter which is not strictly first class, but it is a hard matter to get them to use the extremely poor butter with which the market is flooded. It is believed that if present conditions continue they will result in consumers gradually using less butter and eventually turning to butter substitutes. It therefore seems to be essential, if the butter business is to be maintained on a firm foundation, that the creamery men and the dairymen should realize this danger and raise the standard of their product. While the market inspection can do much toward improving quality, this alone is not sufficient. There should also be an inspection of materials used before they are made into butter, with a view not only to raising the quality of the product, but to protecting the public against unwholesome butter.

The Dairy Division has continued its work of obtaining reports from creameries and giving them assistance in their business methods,

methods of manufacture, and the keeping of records. Each month there has been sent out to the creameries of the country a circular letter containing some specific and pertinent statement or suggestion, and with this letter there has been inclosed a special form for reporting the month's operations. During the year reports were received from 2,016 different creameries, the reports averaging about 600 or 800 to the month. Much valuable information is gathered from these monthly reports as to the amount of milk and cream received from the creamery patrons, the price paid, the amount of butter sold, the overrun obtained, the expense of operating the business, etc.; and this information is used in preparing the monthly letters giving advice to the creameries.

The creameries settle with the farmers on the basis of butterfat contained in the cream. The quantity of butter exceeds the amount of butterfat in the cream because of the incorporation with the butter of water, casein, salt, etc. This excess is termed "overrun" and normally amounts to 18½ per cent. When a creamery fails to show an overrun to this extent it indicates that there is some waste in the methods of manufacture or some fault in keeping the records, and in either case there is a loss to the business. The Dairy Division endeavors to point out to the creameries the fact that they are losing money when this appears from their reports, and to suggest means of overcoming the loss. This work was carried on during the fiscal year 1907 in Minnesota, Iowa, and Wisconsin, and, beginning with June, 1907, was extended to many other States. Comparison of the results for the two years in the three States named shows that the average overrun of the creameries has been raised until it more nearly approaches the normal, with a resulting financial gain estimated at $130,000 for the second year, an amount which exceeds the total expenses of the Dairy Division for the year.

During the year there have been sent out through this section plans for 23 creameries, 7 milk plants, 23 milk houses, 15 ice houses, 18 septic tanks, and 3 moisture test outfits, making a total of 89 plans for which complete specifications were drawn.

RENOVATED BUTTER INSPECTION.

The inspection of renovated butter and of the factories producing the same has been continued in accordance with the act of Congress of May 9, 1902. This work is in charge of Maj. M. W. Lang.

During the fiscal year there were 46 renovated butter factories bonded and which paid the Government tax. This is a decrease of 3 as compared with the previous year. A few of these factories were in operation only a part of the year. The output of these 46 factories during the year amounted to 50,658,159 pounds, being a decrease

of 12,261,840 pounds from the previous year. There were inspected for export during the fiscal year 24,121 packages, containing 1,271,610 pounds of renovated butter, this being a decrease of 4,266,860 pounds.

During the year 190 inspections were made of the factories by representatives of the Dairy Division. Two hundred and fifty-seven samples of renovated butter were analyzed for moisture, and 34 showed a water content of 16 per cent or more. An effort is made to keep the product of inspected factories within the legal limit of 16 per cent of moisture, and in several cases where excessive moisture has been found the facts have been reported to the Treasury Department for prosecution.

WORK FOR THE COMING YEAR.

There are several directions in which the work of the Dairy Division could be extended with great practical benefit to the dairy interests of the country. Statistics show that the average yield of butterfat per cow is less than 145 pounds, or barely enough to pay the cost of feed. It has been demonstrated by dairymen in every part of the country that from 250 to 300 pounds a year are easily obtainable if proper care is used in the selection and breeding of dairy stock. While these facts are known, there has not as yet been worked out a system to make the improvement operative. The possibilities of improvement in this respect are enormous. By doubling the average yield of the 20,000,000 dairy cows in the country, at 20 cents a pound for butterfat, an additional annual gross income would be received by the American farmer amounting to $680,000,000, without increasing the number of animals. There is probably no other farm crop which by such simple means can be made to double itself in a decade. In view of the great possibilities it seems important that the Department should work out a practical plan for increasing the yield of butterfat and should carry out a campaign of education which would lead the farmers of the country to adopt measures which would bring about the desired results. This work, however, as well as other work proposed, can not be undertaken without an increase in appropriation.

Field work such as is being done in the South is greatly needed in some of the Northern and Western States. Work of this kind should be continued until the States take it up and carry it on independently. So far the results indicate that this work, if properly carried on, will eventually be the means of establishing such educational work in the different States on a basis independent of the United States Department of Agriculture. An experiment to determine the best methods of manufacturing and handling farm dairy butter under southern conditions should be begun as soon as practicable, and such investigations should also perhaps be carried on in some of the Western

States. The market inspection of butter could be extended to other cities with great advantage. As yet very little has been done for the cheese industry, and the needs are about as great as in the butter business. There is also a field for studying condensed milk and other milk products.

The production of wholesome milk and the improvement of the milk supplies of cities are subjects requiring more attention and a greater force. Requests for assistance from health officers and others are so numerous that the Dairy Division can do only a small part of the work that should be done in these lines. There are also many problems connected with the dairy industry which require investigations and scientific research and which have a very practical bearing on the future progress and welfare of the industry.

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THE NEED OF STATE AND MUNICIPAL MEAT INSPECTION TO SUPPLEMENT FEDERAL INSPECTION.[a]

By A. M. Farrington, D. V. M.,
Assistant Chief, Bureau of Animal Industry.

To provide clean, healthful, wholesome meats for rich and poor alike is one of the problems of modern civilization. In the early days, when people lived in rural communities, each householder killed animals of his own raising to supply meats for his own family and for his neighbors. In these days, when people are massed in large towns and cities, it is not possible for each individual to know from personal observation the source of his meat supply and whether or not it comes from healthy animals.

The purchaser at the retail store or market can determine whether the meat is satisfactory in appearance, price, and cut, but its source and previous treatment are practically a sealed book and positively unknown to the majority of people.

BRIEF OUTLINE OF MEAT INSPECTION IN THE UNITED STATES.

The first effort to solve the problem of a healthful meat supply for the people of the United States was begun by the Federal Government in the meat-inspection act of March 3, 1891.[b] This act was not adequate for the purpose, in that it did not give sufficient authority to supervise all the processes to which meat is subjected. It enabled the Department of Agriculture to certify that the meat of animals at the time of slaughter was free from disease, but it gave no power to follow the meat through the different processes of curing, pickling, smoking, etc., in the packing house, nor did it give authority to supervise the sanitary condition of the rooms or buildings where the meat was handled. This lack of authority has now been remedied by the Federal meat-inspection act of June 30, 1906. By this act the extent of the meat inspection conducted by the Government has been greatly increased and enlarged.

During the fiscal year ending June 30, 1906, the meat inspection under the several previous acts had been conducted at 163 establish-

[a] This article is based on a paper presented at the Twelfth Annual Convention of the Association of State and National Food and Dairy Departments, at Mackinac, Mich., August 4, 1908.

[b] The act of August 30, 1890, provided for the inspection of meat for export only, and was a commercial rather than a sanitary measure.

ments in 58 cities and towns. In the fiscal year ending June 30, 1907, such inspection had been conducted at 708 establishments in 186 cities and towns, while the number of employees required to put in force the provisions of the new act was 2,290 as against 981 under the former act. There was a proportionate increase in the amount of money spent, $2,159,474 being the amount expended for the fiscal year 1907 as against $771,661 for the previous year. The act of June 30, 1906, makes a permanent annual appropriation of $3,000,000 for meat inspection.

With the authority of this law the Secretary of Agriculture may cause to be made by inspectors, appointed by him for that purpose, an examination and inspection of all live cattle, sheep, swine, and goats before they are allowed to enter any slaughtering, packing, meat-canning, rendering, or other similar establishment where meat or meat food products are prepared for interstate or foreign commerce. He is also required to cause to be made by inspectors, appointed by him for that purpose, a post-mortem examination and inspection of the carcasses and parts thereof of all such animals to be prepared for human consumption at any such establishment for transportation or sale as articles of interstate or foreign commerce. The act makes an exception in the case of animals slaughtered by farmers on the farm and by retail butchers and retail dealers supplying their customers.

The law is very explicit and describes in more or less detail how the inspection shall be conducted. It provides for the issuance of regulations which prescribe the manner of making the inspection. Any person engaged in the slaughtering, packing, canning, or rendering of meat food products for interstate or foreign trade must make application for inspection to the Secretary of Agriculture, on blanks furnished for that purpose, stating the number and kind of animals slaughtered or animal products handled, the amount prepared for local consumption, and the amount prepared for interstate or foreign trade, the applicant agreeing to conform to all lawful rules and regulations. On receipt of this application it is sent to the Chief of the Bureau of Animal Industry, who designates an inspector to visit the establishment and report upon its sanitary condition and its facilities for inspection. If alterations are required in order to conform to the regulations the proprietor is notified in writing, and inspection is not commenced until these changes are made or positive assurances given that the plant will be put in a satisfactory condition.

When these preliminary matters are arranged the necessary force of inspectors is detailed for the inspection. A veterinary inspector is assigned to take charge if the establishment is engaged in the slaughter of animals, and he is furnished with a sufficient number of

assistants to supervise the work according to the regulations. The veterinary inspectors personally conduct the post-mortem inspection of all animals slaughtered. All carcasses which come from healthy animals are marked by a metal or rubber stamp and purple ink with the legend "U. S. Inspected and Passed" and the official number of the establishment.

By selecting meat that bears this stamp consumers are assured that it came from animals found healthy on post-mortem examination. The Federal inspection, however, is limited to establishments that are engaged principally in supplying meat for the interstate or foreign trade. Although some of this meat is no doubt sold for local consumption, a great quantity is put upon sale that does not receive such inspection.

EXTENT OF SLAUGHTER WITHOUT GOVERNMENT INSPECTION.

It will be interesting at this point to inquire into the number of animals that are killed to be consumed within a State. The slaughter of food animals in the United States may be divided into three classes, as follows:

(1) The wholesale and packing, (2) the slaughter by small butchers, and (3) the farm slaughter. The Bureau of the Census has published figures relating to the first and third classes, but not the second, and those relating to the third are somewhat out of date, as they last appeared in the Eleventh Census (1890).

The general public is intimately concerned with the first two classes, as both of them enter into trade. While the wholesale and packing class is wholly included in the Government inspection, such is not the case with class 2 (small-butcher slaughter). It is, therefore, desirable to ascertain the extent of the latter, so as to determine to what degree the people are dependent upon State and municipal inspection for the wholesomeness of their meat products. Although exact figures can not be given, enough can be shown to indicate that the number of animals annually slaughtered by local butchers is probably very much larger than is generally supposed.

The method adopted to find the required number for the year 1907 is based, first, on the numbers of domestic animals in the country on January 1, 1907, as estimated by the Bureau of Statistics, Department of Agriculture; and, second, on the application to these numbers of certain percentages, representing the total annual kill of each species. The percentages referred to have been previously ascertained and published by the Bureau of Animal Industry in the Twenty-second Annual Report, and may be applied to any normal year of live-stock production.

Having thus obtained an estimate of the total number of the various animals disposed of in 1907, it simply remains to deduct (1) the

number slaughtered under Federal supervision, (2) the estimated farm slaughter, and (3) the number exported from the country alive. After these deductions there is left a remainder which necessarily represents the small-butcher slaughter, the whole of which is without Federal inspection.

The totals of these various items are given in the statement below:

Estimated number of cattle, sheep, and swine in United States, and number slaughtered, with and without Federal inspection, etc., during 1907.

Item.	Cattle.	Sheep.	Swine.
Number in United States January 1, 1907 (as estimated by Bureau of Statistics, Department of Agriculture)	72,534,000	53,240,000	54,794,000
Estimated total number disposed of in 1907 [a]	14,507,000	19,166,400	59,725,460
Slaughtered under Federal supervision	7,633,365	10,252,070	32,885,377
Estimated farm slaughter	1,500,000	1,000,000	16,500,000
Exported alive	401,583	121,197	23,783
Remainder—slaughtered by butchers without Federal inspection	4,972,052	7,793,133	10,316,300

[a] Percentages applied: Cattle, 20 per cent; sheep, 36 per cent; swine, 109 per cent.

NOTE.—In addition to the above, there were 2,024,387 calves slaughtered under Government supervision, and probably fully as many without Government inspection.

It is seen from the foregoing that practically 5,000,000 cattle, nearly 8,000,000 sheep, and over 10,000,000 hogs were slaughtered by butchers in 1907 without Federal inspection, to which may be added about 3,000,000 calves. All these 26,000,000 animals were consumed by the people of the United States, and the responsibility of inspecting them has rested wholly upon the State and local authorities, since they are beyond the reach of the Federal inspectors.

LOCAL SLAUGHTERHOUSES AND THEIR EVILS.

The slaughterhouses where animals are killed for local consumption are usually isolated and scattered about the city or town, either situated on some back street, surrounded by stables and dwelling houses, or outside of the corporate limits, each butcher apparently trying to avoid observation. In many instances the houses are located on the banks of streams or creeks, and the drainage is toward such streams. Frequently the offal is thrown on the banks to decay or to be devoured by hogs or rats.

Such houses, in addition to being unsightly, malodorous, unclean, and insanitary in the extreme, are actually centers for spreading disease. Where hogs are slaughtered it is more than probable that a hog infected with trichinæ will be killed. The offal of such a hog when eaten by rats will infect them, and these rats, if later killed and eaten by hogs, will again communicate the disease. Rats act as direct transmitters of trichinosis to hogs, and this is not the only disease which may be spread by offal feeding to hogs.

Old worn-out dairy cows are not infrequently killed at these houses, and from the large amount of tuberculosis found in this grade of cattle it follows that tuberculosis will be communicated to hogs feeding upon the offal.

The local slaughterhouse is also the center of infection for a number of animal parasites which are injurious to live stock, or in some cases even to man, and which are spread by dogs. It is well known that dogs come to such slaughterhouses for food, and when infected viscera are eaten by them they become infected, and through them infection

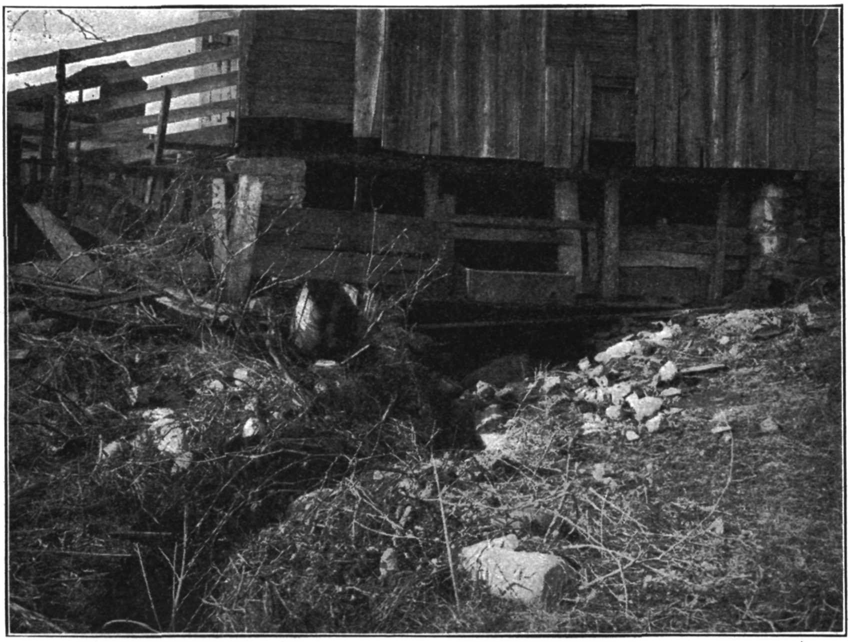

FIG. 1.—Insanitary conditions at small local slaughterhouse. Note the exposed drainage. Hogs are often fed on offal under such abattoirs, and rats and other animals have free access, thus favoring the spread of disease.

may be transmitted to other animals and to man. Several species of tapeworms are distributed in this manner.

Hog cholera is another disease which is spread from local slaughterhouses by improper disposal of the offal. This disease is communicated either by direct infection from hogs eating diseased viscera or by the infection being carried in rivers or creeks and spreading to farms lower down.

That the conditions which obtain at these local slaughterhouses need attention from authorities competent to deal with the situation is shown by a recent investigation made by the State board of health

of Indiana of those slaughterhouses which do not have Federal inspection. The report stated that—

Of the 327 slaughterhouses inspected, only 23, or about 7 per cent, were found to fulfill the sanitary standards. The standards called for in the Indiana pure-food law, approved March 6, 1907, were accepted, and said standards are as follows:

"Insanitary conditions shall be deemed to exist wherever and whenever any one or more of the following conditions appear or are found, to wit: If the slaughterhouse is dilapidated and in a state of decay; if the floors or side walls are soaked with decaying blood or other animal matter; if efficient fly screens are not provided; if the drainage of the slaughterhouse or slaughterhouse yard is not efficient; if maggots or filthy pools or hog wallows exist in the slaughterhouse yard or under the slaughterhouse; if the water supply used in connection with the cleansing or preparing is not pure and unpolluted; if hogs are kept in

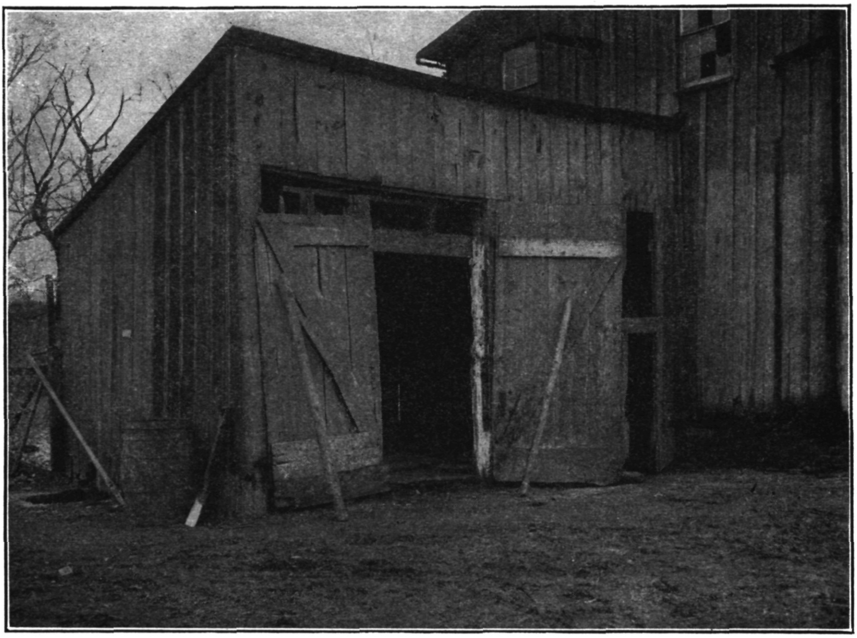

FIG. 2.—Place used as slaughterhouse and carriage house in suburbs of a city.

the slaughterhouse yard or fed therein on animal offal, or if the odors of putrefaction plainly exist therein; if carcasses or parts of carcasses are transported from place to place when not covered with clean white cloths, or if kept in unclean, bad-smelling refrigerators, or if kept in unclean or bad-smelling cold-storage rooms."

At nearly all slaughterhouses inspected, foul, nauseating odors filled the air for yards around. Swarms of flies filled the air and the buildings and covered the carcasses which were hung up to cool. Beneath the houses was to be found a thin mud or a mixture of blood and earth, churned by hogs, which are kept to feed upon offal. Maggots frequently existed in numbers so great as to cause a visible movement of the mud. Water for washing the meat was frequently drawn from dug wells, which receive seepage of the slaughterhouse yards, or the water was taken from the adjoining streams, to which the hogs had access. Dilapidated buildings were the usual thing, and always the most repulsive surroundings and odors existed.

Slaughterhouses of fair sanitary condition were not found. They were all awfully and abominably bad or else met the standard completely.

A concrete example of conditions as they exist may be cited of a large eastern city. In this city there are 275 slaughterhouses which do not have Federal inspection. The approximate combined yearly kill at these plants is nearly 2,000,000 animals, as follows:

Cattle	38,000
Hogs	516,000
Sheep	1,230,000
Calves	108,000
Total	1,892,000

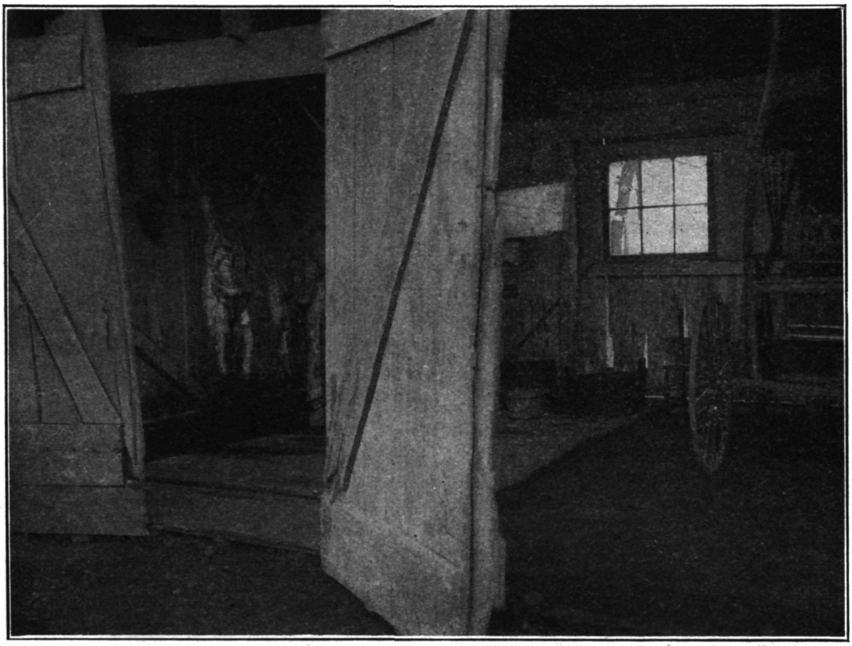

FIG. 3.—Interior of house shown in figure 2.

The meat-inspection force of this city consists of three men—one State inspector and two city inspectors—none of whom are veterinarians, but all of whom were formerly butchers. Their inspection necessarily must be hasty and superficial. It is, of course, a physical impossibility for these inspectors to make a post-mortem examination of all animals slaughtered. They merely make occasional visits to the killing beds, usually when cows are slaughtered.

One of the slaughterhouses of the larger sort in this city kills approximately 5,000 cattle, 150,000 sheep, and 50,000 calves a year, no hogs being slaughtered. This house has been described as follows:

The several departments of the establishment are each in a separate building. The killing department, for example, is in a large barnlike wooden structure.

It has one floor and a basement. Cattle, sheep, and calves are killed in the basement and on the first floor. The basement is floored with cement, but the flooring in the room above is of wood, filthy and insanitary. When slaughtering is being done, heads and hides are piled in heaps on the floor, and livers and tails are scattered about. Butchers frequently hold their knives in their mouths, wear grimy clothes, spit on the floor, and wash down carcasses with dirty water carried about in a bucket.

The ceilings, walls, and pillars are exceptionally dirty; blood and fecal matter besmatter everything.

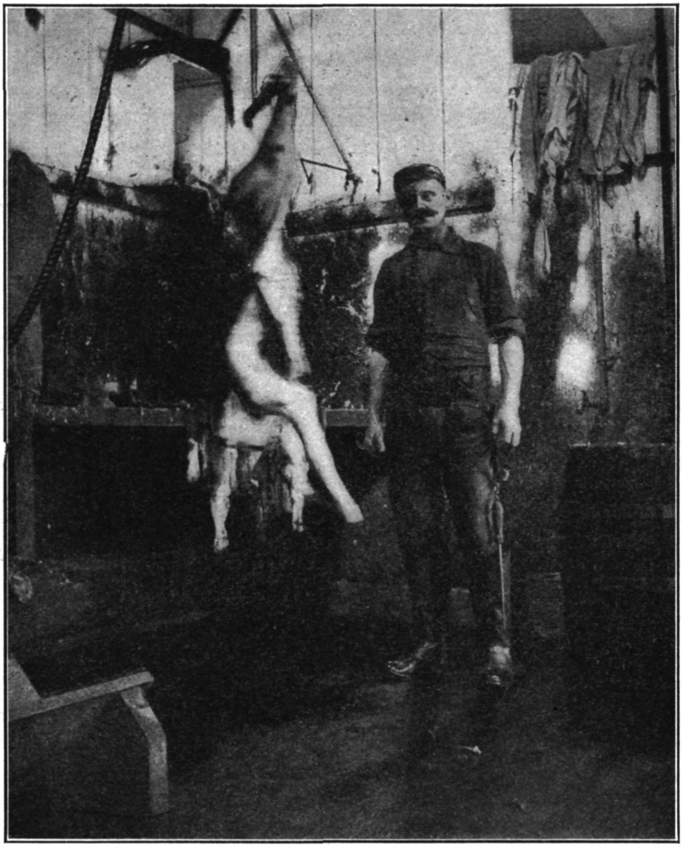

FIG. 4.—Calf-killing room in uninspected slaughterhouse. Observe filthy condition of walls and floor, and dirty clothes hanging on wall. This place handles 5 or 6 carloads of hogs and 10 to 15 cattle a week. The class of cattle killed is mostly worn-out dairy cows, many of which are tuberculous.

The trucks, trays, and other receptacles are filthy, as are the tables on which gut is removed. Chutes and cutting blocks are also dirty, and no effort is ever made to clean them. No toilet room is provided in the building.

The coolers or ice chests are in a revolting condition. The floors are wet and dirty, the walls damp. Livers are thrown on the floor; foul-smelling barrels are allowed to stand on the killing floor. The pens are in an inconceivably filthy condition. The top of the cooler is filled with cast-off shoes and clothes,

hides and cans, and other refuse. Old clothing, reeking with filth, is allowed to hang on the walls of the building.

One of the butchers was asked what they did with "sick" cattle. He laughed and answered, "What do they all do with them?" He told the inquirer that the butchers who killed at this establishment did so because they were afraid to kill where there was inspection, because the Federal inspectors would condemn sick cattle. This simply proves the butchers are carrying out their threat to kill dairy cows where there is no inspection, and thereby put into the meat food trade of the country carcasses which no Federal inspector would ever have passed.

In another large eastern city there are only four slaughterhouses in the city proper which do not have Federal inspection. The total kill

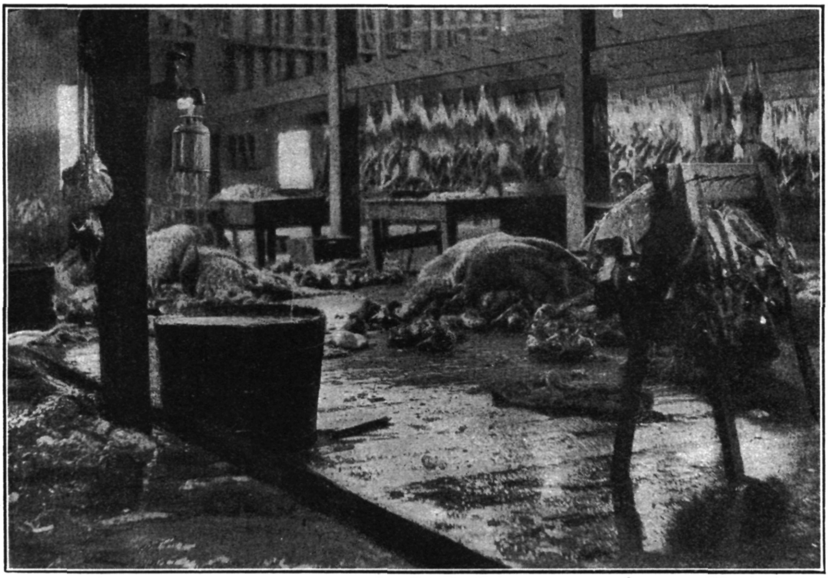

FIG. 5.—Interior of large slaughterhouse in an eastern city, showing insanitary conditions. Many animals which would be condemned under Federal inspection are slaughtered here and their meat is sold for local consumption. This place can not be reached by the Federal authorities, as its product is sold entirely within the State.

at these places is about 1,000 cattle and 2,500 hogs per month. The only inspection is furnished by one inspector of the board of health, and this inspector is not a veterinarian. Previous to his employment by the board of health he was a hotel porter. The sanitary condition of one of the establishments in this city is thus fairly described:

The place was built in 1872 and is falling to pieces, but little attempt being made to repair it. This slaughtering house is composed of three rooms or compartments, each about 20 feet square, only partly partitioned off. One of the compartments is used for the killing and dressing of hogs, one for lard making, and the other as a storeroom for manufactured lard, utensils, boxes, barrels, etc. The gut cleaning is done in the lard room. Steam from the scalding tub, and the foul odor always more or less present in hog-killing rooms, come in

direct contact with the lard in all stages of its manufacture and with the finished product. All floors are of wood and in a shocking condition. The place is supplied with running water, but the floors, walls, ceiling, tables, benches, etc., show but little evidence of its use. The loose material is swept from the floor, but the rest remains. Blood and manure are caked on the woodwork in places an inch thick. The blood and offal are conveyed by pipes and trapdoors to tank cars in basement, and from there taken to the rendering works. The cellar has a cement floor, but it is maintained in a filthy condition. There is no urinal, closet, or toilet connected with the place. The yard, pens, and runways are seldom cleaned, never during the winter months. There is manure in places a foot deep. Livers when first removed from the carcasses are thrown on the floor and later hung on dirty racks in the slaughtering room exposed to flies, filth, and the stench of the place.

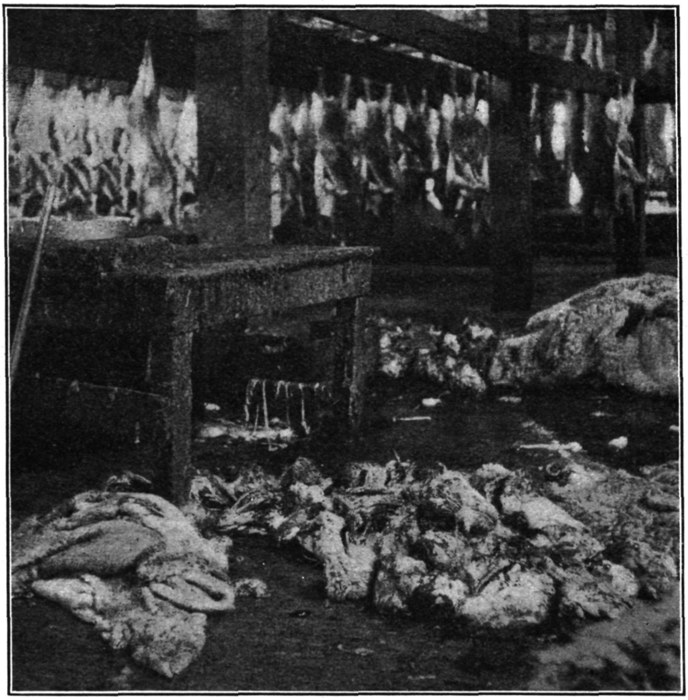

FIG. 6.—Another view of the same establishment shown in figure 5. Note filthy condition of table and floor; sheep pelts and heads strewn on floor.

By these few examples it can be readily appreciated that it is necessary to improve the efficiency of the inspection of meat and meat food products that are consumed entirely within a State.

MUNICIPAL SLAUGHTERHOUSES.

It is impossible to secure an effective system of local meat inspection without either a great increase in the number of competent meat inspectors employed or a concentration of the business of slaughtering. It is largely on account of the multiplicity of slaughterhouses

that thorough systems of meat inspection have not been more generally established. In the small houses very frequently the slaughtering is done at night or very early in the morning, and it would necessitate the employment of a small army of meat inspectors to provide a sufficient number so that one should be present at each place.

The plan of concentration of slaughtering is supported by the experience of all the older civilized countries. It is recommended not only because it facilitates the inspection of meat but because of numerous other advantages. Since the local slaughterhouses are especially prolific sources for the spread of disease, the segregation of such places would materially reduce the number of centers of infection. It would eliminate all of the small, poorly built, badly managed slaughterhouses which are in many instances nuisances in their respective neighborhoods. It would give the small butchers the advantage enjoyed by wholesalers and the large packers, as they could use the machinery installed and the increased facilities supplied in the way of an abundance of hot and cold water for cleansing purposes, all of which are greatly superior in a large plant. The refrigeration also is much better in such a plant and would result in increased wholesomeness of meat to the consumers. The character of the local meat supply would gain in reputation, and local meats could enter into competition with those supplied by the large packers. Unless there is a competition of this kind the tendency of the trade at present is that the large packers will control the supply.

Instead of increasing the cost, the tendency of centralization is to reduce it. A large establishment conducted by cooperation among the butchers would naturally entail less expense than a number of small ones. Moreover, such a system is a great safeguard to the consumer of meats, while it subjects the butchers to no hardships whatever, but makes it more convenient and cheaper for them to conduct their trade. In Europe such union or central abattoirs are owned by the municipalities, and undoubtedly this is the best system, since all butchers are assured of equal rights and privileges. Germany has more than 600 slaughterhouses belonging to municipalities.

If cities and towns of the United States are not prepared to adopt the plan of municipal abattoirs they can at least require a segregation of slaughtering and require animals to receive a careful postmortem inspection at the time of slaughter.

INCREASED VALUE OF BY-PRODUCTS.

One immense advantage to be derived from the consolidation of slaughterhouses would be the increased value received from the by-products, which are practically lost by the small slaughterers.

That the value of such by-products is an important item is apparent from the statement of Mr. J. Ogden Armour, made to the

Bureau of Corporations in the recent investigation of the beef industry. He spoke as follows:

> The ability of wholesale butchers in the small towns to compete with the large packers in the sale of beef depends entirely upon conditions. At times such butchers can buy cattle so cheap that the large packers are almost excluded from doing business in their towns. When such a butcher has to buy his cattle in the same market that the large packers do, we are able, through our economies in manufacture and through making articles of value out of what would go to waste in his establishment, to sell to the retailers at a lower price than the local wholesale butcher can do.

From this statement and from other statements of a similar kind made in the investigation referred to, it is evident that the value of the by-products is an important source of profit; in fact, it has been stated that the packing business of to-day would be carried on at a loss but for the utilization of the by-products. Whether this be true or not, it must be conceded that the saving of these products and converting them into articles of commercial value is a powerful argument for the centralization of small slaughterhouses. It is by this plan of concentration that the modern packing business has grown to its present magnitude, and by following the same plan it is possible for the small butcher to reap substantial rewards.

We must bear in mind that when animals are slaughtered not all of the product is edible meat. Fat cattle, for instance, dress only about 60 per cent of the live weight, sheep 50 per cent, and hogs 80 per cent. The remainder need not be destroyed and become a total loss if there are proper facilities for handling it. This is done in modern abattoirs, but can not be accomplished where there is not suitable equipment. From packing-house statistics it appears, in the case of cattle, that the value of the hide and offal would probably increase the total percentage to 75. In other words, the 40 per cent of offal is equivalent in value to about 15 per cent of meat.

The most valuable product, next to the beef, is the hide, which of course is usually saved by country butchers. But in large abattoirs where many cattle are killed the removal of the hide is so skillfully done that its value is much greater. Tanners pay three-fourths to 1 cent a pound more for such hides than they do for country hides, which are often cut or damaged in stripping.

The next important item is the tallow, which, when properly treated, becomes valuable in the form of oleo oil and stearin. The feet, from which neat's-foot oil is extracted, the bones of the skull, the horns, and even the sinews, may be utilized. When machinery is available for proper preparation, the casings, which are entirely lost in small slaughterhouses, yield a good return, thus saving the expense of importing from foreign countries, which is now done to a large extent.

Other by-products, such as tongues, livers, sweetbreads, beef hearts, tripe, and blood albumen, with proper attention and refrigeration, can be available for food, where formerly they were thrown away as useless and not worth the trouble required to keep them.

The tankage is still another product which is of value. The liquid that is pressed out of the tankage is saved, and, after boiling and treating with chemicals, is known as "concentrated tankage" and is sold on an ammonia basis.

An accurate idea of the value of slaughterhouse by-products can be gained by referring to an example cited in F. W. Wilder's book, The Modern Packing House. This book is an acknowledged authority on the packing business, and the data presented refer to the yield of a bunch of 34 cattle, obtained in actual operation at the prevailing market prices (1905).

Yield of 34 cattle.—Average live weight, 1,259 pounds; average dressed weight, 750 pounds; average weight of hide, 89 pounds. Excluding the dressed meat and the hides, the remainder (offal) realized as follows:

"Trimmings" (tongues, livers, hearts, tails, head meat, etc.)	$42.03
Casings	17.73
Sweetbreads	1.80
Tripe	3.55
Heads and feet	33.99
Blood	4.82
Sinews	.46
Tallow (converted into oleo oil and stearin)	252.42
Total	356.80

In addition to the above there were 2,665 pounds of "tankage," being 78.38 pounds a head. This tankage consists of the bony portions of the heads, and all the other refuse of the slaughtering operations. This material is rendered in the tank, and after extracting the fat the residue is converted into more or less valuable by-products, as ammonia, etc. This matter of tankage, in particular, illustrates the close business methods that are being applied in the modern abattoir.

However, taking the total value of the offal, including tallow, as given above, and dividing by the number of cattle experimented with (34), the value of offal per head is seen to be $10.49. If to this is added the tankage at $16 a ton, the total is increased to $11.05. Assuming that the animals cost an average of $80 a head alive, the offal then amounted to fully 14 per cent of the live value, which gives a good indication of how much may be lost through wasteful methods. Similar economy is exercised in the slaughter of sheep and hogs; it is therefore unnecessary to go into details in regard to these classes of

animals. What has been said shows without doubt that the loss of the whole or any considerable part of the by-products would make a very appreciable difference in a year's operation at any good-sized abattoir.

It would seem, if for no other reason than the saving of these by-products, that concentration in slaughtering and competent inspection should be advocated and upheld from a commercial point of view.

PUBLIC EFFORT NECESSARY FOR REFORM.

Since the Federal law will not permit meat slaughtered under the insanitary conditions herein mentioned to enter into interstate and foreign trade, nothing remains but for it to be consumed within the State; it is therefore necessary for public opinion and effort to bring about a more cleanly and healthful condition in this direction. Let organizations having similar objects in view as this bring before the people the revolting conditions under which some of our meat is supplied and public sentiment will soon force those in authority to take measures to better these conditions.

This question of an adequate State inspection of meat was emphasized by Miss Alice Lakey, chairman of the food committee of the National Consumers' League, in an address delivered at the Jamestown Exposition July 19, 1907, in connection with the eleventh annual convention of the Association of State and National Food and Dairy Departments. Miss Lakey said, in part:

> Will not this body of State and National officials use its influence to help in prevention by securing State inspection of cattle, slaughterhouses, and meat? Why are so many consumers acceding to the demands of the meat trust by paying increased prices for meat? Because such meat bears the stamp of the Federal inspector and the consumer has been educated by the public press to believe that such meat is safe. Many consumers refuse all meat not so labeled. Can not the States give consumers a label on State meat that shall be equally reassuring?

It is only fair to say, in conclusion, that a packer who submits to Federal inspection and destroys all animals that are unfit for food purposes incurs a heavy expense not known to the slaughterer who has no inspection of any kind and who sells diseased meat at the same price that he receives for healthy meat. Consequently the packer or slaughterer whose product is subjected to a rigorous inspection should receive, in all fairness, a higher price for his product than the packer or slaughterer who operates without inspection.

THE ECONOMIC IMPORTANCE OF TUBERCULOSIS OF FOOD-PRODUCING ANIMALS.[a]

By A. D. MELVIN, D. V. S.,
Chief of the Bureau of Animal Industry.

INTRODUCTORY.

It is the purpose of this paper to call attention briefly to the serious injury which tuberculosis causes to the live-stock industry from the economic standpoint and to suggest means of overcoming it, discussing the subject as it affects the United States. Regardless of the question of the communicability of tuberculosis from animals to man and the bearing of animal tuberculosis on the public health, it is a well-known fact that this disease causes heavy financial loss to the live-stock industry; and while the saving of human life affords the highest motive for combating tuberculosis, the prevention of financial loss is alone a sufficient reason for undertaking the eradication of the disease from our farm animals.

The movement in the last few years for a more wholesome food supply has resulted in drawing attention to the part played by tuberculosis as regards both health and economics. It must be realized that the exclusion of tuberculous meat and dairy products from the food supply means an appreciable reduction in the quantity of available food, with a corresponding tendency to an increase in the cost of necessaries of life. The economic problem therefore concerns not only the stock raiser and the producer, but the consumer, which means practically everybody. No nation is so wealthy that it can afford to sacrifice year after year a considerable and increasing proportion of its food supply, especially when by proper means the loss can be reduced and in time prevented entirely. This is a problem which must be faced eventually, and the earlier this is understood the more easily it can be solved.

THE PREVALENCE OF ANIMAL TUBERCULOSIS.

While tuberculosis among animals is less prevalent in the United States than in some other countries, it has progressed to an alarming extent even in this country, and is undoubtedly on the increase, especially in States where no adequate measures have been taken against it. The animals principally affected are cattle and hogs. The disease readily spreads among cattle that come in close contact with each other, as in dairy herds, and experiments by the Bureau of Animal Industry have shown that it is easily communicated from

[a] This paper was read before the International Congress on Tuberculosis at Washington, D. C., September 29, 1908.

cattle to hogs by the common practices of giving skim milk to hogs and allowing them to feed on the excrement of cattle. The increase of tuberculosis among hogs in the United States has been very marked in recent years. Sheep and goats are rarely affected, probably because of a natural tendency toward immunity or because they are not generally exposed to infection.

The two principal sources of data as to the prevalence of tuberculosis among live stock are (1) meat-inspection statistics and (2) records of the tuberculin test. Meat inspection throws light on the disease in cattle, hogs, sheep, and goats, while the information derived from the tuberculin test is practically confined to cattle.

MEAT-INSPECTION STATISTICS.

The Federal meat inspection, as extended under the law of June 30, 1906, now covers more than half of all the animals slaughtered for food in the United States, and the proportion of animals found affected with tuberculosis under this inspection service affords a basis for forming some idea of the extent to which the disease exists among the meat animals of the country.

The following table shows the number of animals of each kind slaughtered under Government inspection during the fiscal year ending June 30, 1908, and the number and percentage found affected with tuberculosis:

Animals slaughtered under Federal inspection in the United States, with number and percentage found tuberculous, during fiscal year 1908.

Kind	Number slaughtered.	Number tuberculous.	Percentage tuberculous.
Cattle	7,116,275	68,395	0.961
Calves	1,995,487	524	.026
Hogs	35,113,077	719,309	2.049
Sheep	9,702,545	40	.000
Goats	45,953	1	.000
Total	53,973,337	788,269	1.460

Even a larger proportion of the animals slaughtered at establishments without Federal inspection are tuberculous, as one effect of a rigid inspection is to cause the establishments under inspection to exercise care in buying animals so as to minimize condemnations, while suspicious-looking animals are naturally diverted to the small local abattoirs that have no inspection. This was demonstrated by comparing results at establishments soon after they were placed under inspection by the new law with those at establishments where inspection had been in force for a long time, relatively twice as many cattle being condemned for tuberculosis at the former as at the latter places.

Taking these facts into consideration, it seems likely that more than 1 per cent of the beef cattle in the United States are affected with

tuberculosis to some degree, while over 2 per cent of the hogs slaughtered are affected.

THE TUBERCULIN TEST.

It is known that dairy cattle are more generally affected than beef cattle, as the tuberculin test has shown that from 5 to 25 per cent of the cows supplying milk to certain cities were tuberculous. For instance, tests made in 1907 on a large proportion of the herds supplying milk to the city of Washington showed about 17 per cent of the cattle reacting.

For fifteen years the Bureau of Animal Industry has been preparing tuberculin and supplying it to State and city authorities for official use, besides using it in tests by its own employees. Recently the reports of tests made with this tuberculin during this period have been carefully analyzed and tabulated. Out of 400,000 cattle tested there were 37,000 reactions, or 9.25 per cent.

The majority of the cattle tested were dairy cattle, and the tests were made under various conditions. By far the larger proportion of the tests were made on cattle that had been within a State for a year or more. In some cases tests were made compulsorily on all cows supplying milk to a city; in other cases they were made when requested by owners, and in still others when the presence of tuberculosis was suspected in certain herds. It is impossible to determine accurately the weight of all these factors; but considering the fact that while dairy cattle largely predominated their average is reduced by a certain proportion of other cattle, and offsetting against this the fact that the testing of herds under suspicion tends to raise the average somewhat, it seems reasonable to conclude from these tests that at least 10 per cent of the dairy cattle in the country are affected with tuberculosis.[a]

A remarkable feature of the reports referred to is the manner in which the diagnosis by the tuberculin test was confirmed by post-mortem examination on reacting animals that were slaughtered. Out of 24,784 reacting animals slaughtered, lesions of tuberculosis were found in 24,387, a percentage of 98.39. The Bureau has positive knowledge that in at least one State the testing was not done in a careful and reliable manner. If we discard the returns from this State, the proportion of cases in which the tuberculin reaction was confirmed by post-mortem is raised to 98.81 per cent. It is possible, too, that in some of the negative cases tuberculosis was really present, but the lesions were so slight as to escape detection on post-mortem examination by ordinary methods. Surely these figures, representing the work of scores of individuals in all parts of the United States

[a] Schroeder, in another paper in this volume (p. 148), estimates that not less than 20 per cent of the dairy cows are tuberculous.

over a period of fifteen years, bear strong testimony to the marvelous accuracy of the tuberculin test. Further evidence on this point is afforded by the slaughter, during the past year or two, in or near the city of Washington, of 126 cattle which had reacted to the test when applied by Bureau veterinarians, with only one failure to find lesions of tuberculosis on post-mortem examination, the percentage of accuracy being 99.21.

Properly prepared tuberculin applied by competent persons is thus shown to be a wonderfully reliable agent for diagnosing tuberculosis. In cases where the test appears to give unsatisfactory results this is usually due to the use of a poor quality of tuberculin or to ignorance or carelessness in applying it.

The following table shows the result of the tests above referred to, arranged according to States:

Results of tuberculin tests of cattle by State and Federal officers with tuberculin prepared by the Bureau of Animal Industry, 1893 to July 31, 1908, inclusive.

State.	Number of cattle tested.	Number reacting.	Percentage reacting.	Number of reactors slaughtered.	Number found tuberculous on post-mortem.	Percentage found tuberculous on post-mortem.
Alabama	20	0	....	....	....	....
Arizona	49	16	32.65	16	16	100.00
California	9,618	1,112	11.56	872	872	100.00
Colorado	822	50	6.08	14	13	92.86
Connecticut	6,080	852	14.01	750	748	99.73
Delaware	7	0	....	....	....	....
District of Columbia	8	7	87.50	5	5	100.00
Florida	1	0	....	....	....	....
Georgia	49	19	38.78	....	....	....
Idaho	10	0	....	....	....	....
Illinois	7,120	790	11.09	619	597	96.45
Indiana	2,935	246	8.38	129	127	98.45
Iowa	4,020	778	19.35	239	220	92.05
Kansas	120	4	3.33	4	3	75.00
Kentucky	327	37	11.31	13	12	92.31
Maine	3,264	149	4.56	116	109	93.97
Maryland	58	8	13.79	6	6	100.00
Massachusetts	86,223	11,853	13.75	10,760	10,688	99.34
Michigan	2,155	351	16.29	97	95	97.94
Minnesota	60,733	3,031	4.99	172	135	78.49
Mississippi	133	9	6.77	....	....	....
Missouri	1,680	133	7.92	4	4	100.00
Montana	62	25	40.33	2	1	50.00
Nebraska	105	49	46.67	18	18	100.00
New Hampshire	164	20	12.18	19	19	100.00
New Jersey	3,293	828	25.14	584	579	99.15
New Mexico	196	1	.51	1	1	100.00
New York	4,034	565	14.00	533	532	99.81
North Carolina	1,207	208	17.23	43	28	65.12
North Dakota	702	130	18.52	13	13	100.00
Ohio	2,933	425	14.49	69	68	98.55
Oklahoma	385	4	1.04	2	2	100.00
Oregon	1,466	351	23.94	274	266	97.05
Pennsylvania	90	25	27.77	7	7	100.00
Rhode Island	653	125	19.14	104	104	100.00
South Carolina	395	40	10.12	1	1	100.00
Tennessee	88	7	7.95	....	....	....
Texas	76	0	....	....	....	....
Utah	120	21	17.50	12	12	100.00
Vermont	162,570	10,628	6.54	8,248	8,166	99.00
Virginia	899	158	17.58	101	98	97.03
Washington	2,779	455	16.37	10	8	80.00
West Virginia	60	13	21.67	12	12	100.00
Wisconsin	32,297	3,477	10.77	915	802	87.65
Wyoming	2	0	....	....	....	....
Total	400,008	37,000	9.25	24,784	24,387	98.39

In this compilation the following basis has been adopted in determining what constitutes a reaction, as in the experience of the Bureau of Animal Industry this method has been found to give reliable results: A reaction consists of a rise of 2° F. or more above the highest temperature before injection, provided the maximum temperature after injection reaches 103.8° F.

It should also be explained that the number of tests shown in the table represents only those of which the Bureau received reports, and not the entire number of doses of tuberculin prepared and distributed by the Bureau during the period named.

Assuming that 10 per cent represents the prevalence of tuberculosis among dairy cattle as indicated by tuberculin tests, and 1 per cent among cattle slaughtered for beef, as shown by the meat-inspection figures, and taking 21,194,000 as the number of milch cows and 50,073,000 as the number of other cattle in the United States on January 1, 1908, as estimated by the Bureau of Statistics of the Department of Agriculture, we conclude that as a general average about 3.5 per cent of the cattle of this county are affected with tuberculosis.

ECONOMIC LOSSES FROM ANIMAL TUBERCULOSIS.

While the financial loss caused by tuberculosis of farm animals can not be calculated with exactness, a study of the subject affords a basis for estimates sufficiently close to show that it is a serious drain on the live-stock industry.

LOSS ON TUBERCULOUS ANIMALS SLAUGHTERED.

The writer recently made an effort to collect reliable data as to the loss caused by tuberculosis in animals slaughtered under Government meat inspection. Carefully compiled figures were obtained from a number of large firms engaged in the slaughtering and meat-packing business, in one instance the calculations covering an entire year's business. In arriving at the loss the general method, in brief, was to deduct from the average cost of a live animal of a certain class the average amount realized from a tuberculous carcass of that class, the difference representing the loss.

Under the inspection system the animals found tuberculous are disposed of in three classes, according to the extent of the disease. Carcasses which show very slight infection may often be safely passed for food after the removal of the lesions, the loss in such cases of course being small. Other carcasses, affected to a somewhat greater degree, but still not badly diseased, are allowed to be rendered into lard or tallow at a sterilizing temperature after all diseased portions have been cut away and condemned. In these cases the loss is more considerable. A third class comprises carcasses that are considered unfit for food in any form and are totally condemned. The loss on these

is still greater, amounting in the case of cattle to about three-fourths of the cost. The salvage consists of the hide, grease, fertilizer, etc.

The loss on condemned adult cattle was found to vary from $10 to $75 a head, according to grade, price, weight, etc. While the loss per carcass is of course heavier on the higher priced animals, the proportion of condemnations is much greater among the cheaper grades. After weighing these factors and studying the figures the writer has concluded that for the purpose of this paper the condemned cattle may be grouped in two general classes, one representing about the average of the better grades, including those known as native and western cattle, in which steers largely predominate, and the other representing the cheaper grades and lighter weights, including "cutters" and "canners," largely cows. At present Chicago market prices the loss on the first class, when condemned, is estimated at $45 a head and on the second class at $18 a head. These figures are believed to be conservative and below rather than above the actual losses, as are all the estimates made in this article. It is also estimated that two-thirds of the condemnations occur in the cheaper class of cattle and one-third in the higher class. This proportion gives $27 a head as the general average loss on condemned cattle. On carcasses rendered into tallow the average loss is estimated at $20. On a percentage basis the combined average loss on cattle carcasses condemned and those rendered into tallow is about 70 per cent of the cost of the live animals. The loss on beef carcasses passed for food is very slight, being estimated at 50 cents each.

The loss on calves condemned is about $7 a head, and the loss on those passed for food after condemning an organ or part is estimated at 25 cents a head.

The average loss on tuberculous hogs is estimated at $8.50 (or 55 per cent) on those condemned, $5.75 (or 38 per cent) on those rendered into lard, and 50 cents on those passed for food.

Applying the foregoing figures to the number of animals found tuberculous in the Federal meat inspection during the fiscal year ending June 30, 1908, the annual loss is as follows:

Cattle	$710, 677
Hogs	1, 401, 723
Sheep and goats	35
Total	2, 112, 435

The significance of this loss may be better appreciated when it is known that tuberculosis is the cause of two-thirds of the entire loss resulting from condemnations at the time of slaughter in the meat-inspection service.

The loss on animals slaughtered without Federal inspection can not be so readily computed. Some States and municipalities have more

or less efficient inspection systems, but the great majority of the animals slaughtered without Government inspection are not subjected to inspection of any kind, and it has already been pointed out that tuberculosis is doubtless more prevalent among them than among those coming under Federal inspection. It is safe to say, however, that without inspection the actual loss is very slight. Nevertheless the writer is of the opinion that the loss should be computed as it would occur under efficient inspection. Applying to the number of animals slaughtered without Federal inspection the same factors that were used for those coming under inspection, but assuming that the cattle are generally of an inferior quality and worth 25 per cent less, it is estimated that the loss because of tuberculosis among animals slaughtered without Government inspection would, if proper inspection were applied, reach $1,720,000 a year, making the aggregate estimated loss on all food animals killed in the United States $3,832,435 annually.

DEPRECIATION IN VALUE AND OTHER LOSSES.

Aside from the loss on animals slaughtered, tuberculosis unquestionably causes a considerable depreciation in the value of those remaining alive. There are no definite data upon which to calculate this depreciation, but it is entirely reasonable to estimate that tuberculous milch cows decrease in value annually at least one-tenth of what the loss would be if they were slaughtered and condemned, while other cattle depreciate annually one-third and hogs one-half of such loss. On this basis, taking the estimate of the Bureau of Statistics of the Department of Agriculture as to the number and value of farm animals in the United States January 1, 1908, and assuming that 10 per cent of dairy cattle, 1 per cent of other cattle, and 2 per cent of hogs are tuberculous, the total annual depreciation is no less than $8,049,889.

Tuberculosis also has the effect of decreasing the productiveness of dairy cows by diminishing the yield of milk as well as, perhaps in some cases, by shortening their lives, and consequently the period during which they produce milk. Again, the amount of the loss is largely a matter of conjecture, but the writer feels that he is within reason in estimating that the average milk yield of a tuberculous cow is 10 per cent less than that of a healthy cow, and on this basis the annual loss, valuing milk at wholesale prices, is fully $10,000,000.

Serious damage is caused by tuberculosis from the standpoint of breeding. The disease is found to a greater extent in purebred herds than in common stock. In adding fine animals with a view to "breeding up" his herd, an owner may unwittingly also introduce tuberculosis, with disastrous results. By causing unthriftiness and

impairment of fecundity the disease has an adverse effect upon the number and value of the offspring.

The influence of tuberculosis toward increasing the cost of meat and dairy products has already been alluded to. There is also a considerable economic loss resulting from the destruction of cattle in the efforts already being made in some States to eliminate the disease. The trade in live animals and in animal food products also suffers losses because of tuberculosis. Doubtless there are still other sources of loss chargeable to this disease in live stock, such as the expense of maintaining a sanitary service, disinfection of premises, etc.

THE AGGREGATE LOSS.

Taking into consideration the various items mentioned, the tribute which the United States pays each year to this scourge among its farm animals aggregates more than $23,000,000.

Such a loss is too great, merely as a matter of economics, to be allowed to continue and increase from year to year. And when in addition we consider the bearing of animal tuberculosis on human health, it seems imperative that vigorous measures should be taken to eradicate the disease from our herds, especially when such eradication seems entirely possible and practicable.

THE CONTROL AND ERADICATION OF TUBERCULOSIS.

Any efforts to reduce or control tuberculosis of live stock in order to be of lasting value must have eradication in view as the final object. We should not temporize with such an insidious malady, but should adopt aggressive measures that will insure success within a reasonable time.

It has been clearly shown by the work of the Bureau of Animal Industry and by other investigations that hogs readily contract tuberculosis from cattle and that diseased cattle are the primary source of the infection in hogs. The main problem, therefore, is to eradicate the disease from cattle, and when this is accomplished tuberculosis may easily be eradicated from hogs.

The eradication of animal tuberculosis may as well be recognized at the outset as a tremendous undertaking, which will require not only the best efforts of the authorities in charge but the sympathy and support of stock owners and the general public. Large sums of money will be necessary, and in order that adequate appropriations may be obtained, the necessity and importance of the work must be generally realized and understood.

WHAT MAY BE DONE BY INDIVIDUALS.

With proper assistance much can be done by the individual stock owner to exclude and eliminate the disease from his animals. He

should be careful to avoid the introduction of tuberculosis into his herd by requiring that any cattle purchased shall have passed the tuberculin test. He can also do much to promote the health of his animals by keeping them in sanitary stables and under hygienic conditions. When tuberculosis is suspected he should notify the authorities and have his cattle tested. When the presence of the disease is known the safest course is to have the affected animals slaughtered, but in the case of valuable breeding stock, where slaughter would involve great sacrifice, the Bang system of segregation may be used.

EDUCATIONAL WORK.

The individual, however, must first be aroused as to the danger of having tuberculosis in his herd and the importance of eradicating it, and he must also be informed as to the nature of the disease and the best methods of combating it. Valuable work in this direction may be done by the general and agricultural press and by official publications, also by lectures at public gatherings, farmers' institutes, etc.

GOVERNMENT AND STATE MEASURES.

If the campaign for the eradication of animal tuberculosis is to be comprehensive, systematic, and generally successful, it must be directed by Federal and State officials conjointly, who must be armed with adequate laws and funds and supported by public opinion.

Excellent work has been done by the authorities of several States during recent years, but a study of the laws and regulations of all the States shows that in most of them the importance of the subject is not appreciated. Thirteen of the States at present require the tuberculin test on cattle brought in, this requirement usually being limited to cattle intended for dairy or breeding purposes. Fourteen States have provisions for the slaughter of animals found affected with tuberculosis and the payment of indemnity to the owners, while a few others give authority for condemnation and slaughter without making provision for indemnity.

The work of the Federal Government, as carried on by the Bureau of Animal Industry, so far consists (1) in supplying tuberculin free of charge to State officers, (2) in endeavoring to prevent the interstate shipment of tuberculous animals, and (3) in tracing when practicable the origin of animals found affected with tuberculosis in the meat-inspection service and notifying State authorities.

As a basis for further work Federal and State authorities should first determine in what localities tuberculosis exists to the greatest extent among live stock (where this has not already been done), and should first apply the tuberculin test generally and systematically to cattle in such sections.

The safest way of disposing of reacting animals, as previously stated, is to slaughter them. In order to reduce the financial loss to a minimum and at the same time guard against the sale of unwholesome meat, it is well to have such animals slaughtered at abattoirs under Federal or other competent veterinary inspection. In this way a large proportion may be safely passed for food and made to yield their full meat value, while only those whose meat may be dangerous to health will be condemned.

In herds where the disease is found it is advisable to repeat the tuberculin test at intervals of six months, and after the disease has apparently been wiped out the test should still be applied once a year until it is known beyond doubt that infection does not remain and has not been reïntroduced.

Inspectors should be stationed at important points for the purpose of testing cattle for breeding and dairy purposes, and each State that is endeavoring to eradicate the disease should require that no cattle for breeding or dairy purposes shall be admitted from without the State unless they have passed the tuberculin test. A good method of preventing the spread of tuberculosis among breeding stock would be the establishment by the State of one or more free herds of breeding cattle for the use of stock raisers in the State, or the State could certify to the health of free herds.

An effective means of locating and eradicating tuberculosis of live stock would be to establish by State legislation a system of tagging cows sent to market from infected districts for slaughter, so that when any are found tuberculous in the meat inspection they may be traced back to the place of origin, thus locating the centers of infection, and steps may then be taken for eradication. The Bureau of Animal Industry is already cooperating with the authorities of some States by reporting on tuberculous animals, and the results so far have been very encouraging. To give the plan general application the authorities should be empowered by law to require that shippers shall tag their cows in such a way that they may be identified and their origin determined.

As the eradication of tuberculosis is largely a public-health measure, it is only reasonable that the State should compensate, at least in part, the persons whose cattle are slaughtered. This is not only fair, but it is absolutely essential if the cooperation of the cattle owners is to be secured.

It will be seen from the methods above discussed that in carrying on work for the eradication of animal tuberculosis in the United States hearty cooperation and concurrence of action between the Federal and State governments will be essential. Under the Constitution the power of the Federal Government in such matters is limited to those aspects which concern interstate commerce, and if a State fails

to do its part the Federal Government can not step in and carry on the work. What the Federal Government can do in such a case, however, is to quarantine the State, or a portion of it, and thus prevent the movement of animals from such a State; but while this action would protect other States, it would not help the situation within the State.

BENEFITS OF ERADICATION.

The economic advantages of eradicating tuberculosis from farm animals are too apparent to require extended discussion. They will come to the individual stock raiser and dairyman as well as to the public and the nation. Breeders are beginning to understand that it is unprofitable to go on raising cattle while tuberculosis exists in their herds. The practice is becoming more general for buyers of breeding and dairy cattle to have such animals tested before placing them in their herds, and the breeder who can give assurance that his herd is free from tuberculosis has a decided advantage in making sales. With the agitation in favor of a more wholesome milk supply there is coming a growing demand for milk from healthy herds at higher prices, and as this demand increases the dairyman who can not show a clean bill of health for his cows will find it more difficult to market his products.

To overcome the great losses before mentioned is worth considerable effort and expense. The benefits to follow from the eradication of tuberculosis from farm animals are so great and so obvious that the necessary expenditures, even though they must be heavy, may be regarded as a highly profitable investment.

THE RELATION OF THE TUBERCULOUS COW TO PUBLIC HEALTH.

By E. C. Schroeder, M. D. V.,
Superintendent of the Bureau Experiment Station.

INTRODUCTION.

Under the conditions of our present civilization the dairy cow fills a unique place. Her living body is the source of the most important of all human foods; she has become an essential factor among our modern institutions; remove her and either a substitute must be found or many thousands of young children will die of starvation. The woman who can feed her infant at her own breast until it is old enough to thrive without milk is probably nearer the exception than the rule, so that either the cow or some other milk-producing animal must, as a sheer necessity, be available to serve the purposes of a human foster mother. After children have passed the period during which milk is a requisite article of food, most of them continue its use as a beverage and add butter to their diet as a second product from the cow. Later on cream and cheese are added, and the use of milk to some extent as a beverage, and of cream, butter, and cheese as regular, current articles of food is continued to the end of life. Hence, even if we are not greatly influenced by the idea that it is disgusting and barbarous to eat substances that are obtained from the living bodies of diseased cows, we must feel that it is important to make a careful inquiry regarding the transmissibility to ourselves, through the use of dairy products, of the commonest disease with which dairy cows are affected. The need for this inquiry is emphasized by the knowledge that the commonest and most important disease of cows is also the commonest and most important disease of mankind, and by the fact that, though the disease in question—tuberculosis—is one of the few infectious diseases to which widely different species of animals are susceptible, its commonest victims are persons and dairy cows.

The indispensable cause of tuberculosis is the multiplication of tubercle bacilli in the animal body. Bacilli do not grow and multiply in animal bodies until they have been introduced into them from without, and tubercle bacilli grow and multiply nowhere else in nature. The propagation of tuberculosis, therefore, depends upon the

tubercle bacilli that emanate from the bodies of tuberculous individuals, human and animal, and the widespread and common occurrence of tuberculosis is due to the unguarded and dangerous expulsion and dissemination of tubercle bacilli by the victims of tuberculosis. This is the basis for the practically unanimous conclusion among those who are informed on the subject that, in our fight for the suppression and eventual eradication of tuberculosis, we must strive to control and make harmless all the sources from which tubercle bacilli are scattered.

As persons and dairy cows are the commonest subjects of tuberculosis, they are also the commonest sources from which tubercle bacilli emanate, and as the exposure of persons to persons, through the ordinary routine of life, and the exposure of persons to dairy cows, through the lifelong use of dairy products, are commoner and more direct and intimate than the exposure of persons to other possible sources of tuberculous infection, we may conclude that the two most important sources of tubercle bacilli, against which public health must seek to defend itself, are tuberculous persons and tuberculous dairy cows. Of these two sources the former is probably the more important, but only little can be said about it here, as the latter is the subject of this article, and the little that is permissible must be limited to the infection of dairy products when they are exposed to tuberculous or consumptive persons.

Persons affected with tuberculosis of the respiratory passages, lungs, throat, etc., expel tubercle bacilli with their sputum and with the particles of fluid sprayed from their mouths and noses during accelerated expiratory acts. Such persons are regarded as not necessarily dangerous to public health when they observe a number of simple precautions relative to the disposal of the infectious material which they expel from their bodies, but they can not keep their environment sufficiently free from tubercle bacilli to make it a safe place for the exposure of food that is to be eaten by others. Dairy products are usually eaten in a raw state; that is, without previous exposure to a germicidal process like cooking, and hence it is especially desirable that they should not be handled by, nor be exposed in the environment of, tuberculous persons.

The expulsion of tubercle bacilli by those who are affected with tuberculosis and the mode of its occurrence justify the enforcement of health regulations that will exclude all tuberculous persons from serving in occupations such as food venders, cooks, waiters, milkers, creamery employees, butter makers, etc. This statement may appear to some persons as savoring a little of that inordinate fear of tuberculosis which has been discussed by many writers under the name of phthisiophobia, but for that reason it can not be lightly dismissed, especially as even positive phthisiophobia has not been proven to be

altogether unreasonable. It is regrettable that the protection of public health often necessitates the imposition of annoying and impeding restrictions that add to the cares of those whose lives are burdened with a serious disease. But what other course can we follow?

Tuberculosis, unfortunately, is infectious, and the best way to escape it is to shun the virus to which it is due and to avoid the source from which this virus is expelled. A policy that attempts to characterize as anything better than extremely dangerous the sources from which the essentially necessary causative agent of an infectious disease that is responsible for more than 10 per cent of all deaths is derived is very shortsighted. To refrain through motives of sympathy and charity from imposing various irksome and disadvantageous restrictions on those who are the unhappy victims of tuberculosis is equivalent to making sentiment an apology for the sacrifice of thousands of healthy persons in the present generation and millions in coming generations to a deadly plague.

When we actually realize the truth about tuberculosis and the number of victims that it claims we are in a better state of mind to join those who may be classed as afflicted with phthisiophobia than those who seek to belittle the dangerous character of tuberculous individuals for their fellow-creatures. During 1908, according to the most reliable figures obtainable, 160,000 human lives were prematurely ended by tuberculosis in the United States alone, and this enormous number does not include the deaths hastened by tuberculosis but chargeable to other immediate causes. Every one of these deaths was due to infectious material that had its origin within and was expelled from the bodies of tuberculous persons and animals.

There is too strong a tendency at the present time to characterize the careful consumptive as not dangerous to those with whom he is associated. No doubt he is a less danger than the careless consumptive, but we can not afford to teach that the degree of danger he represents is so small that we can safely afford to disregard it. We must bear in mind that the infectious disease with which he is affected, according to the figures presented at the recent International Congress on Tuberculosis by the United States Public Health and Marine-Hospital Service, destroyed 60,000 more lives in the United States last year alone than yellow fever destroyed in the United States during the whole of the last century.

The writer, whose knowledge of tuberculosis and its mode of transmission is derived from years of special study, attempted recently to protect his environment from infection with such particles of material, emanating from his own body, in which tubercle bacilli are commonly expelled from the bodies of persons affected with pulmonary or laryngeal tuberculosis. The conclusions drawn from this attempt are in accord with the investigations of Bartel and

Spieler,[a] who liberated a number of guinea pigs in the dwelling of an intelligent, careful consumptive, who used a sputum flask to prevent spreading tubercle bacilli with the material he expectorated, and who, no doubt, under the direction of the investigators, took every reasonable precaution to protect his environment from becoming infected with tubercle bacilli expelled from his body. A portion of the guinea pigs contracted tuberculosis from this exposure, thus proving that the environment of even a careful consumptive is by no means free from active, virulent tubercle bacilli, and therefore is not safe.

As some objection may be made to the quoted experiment because of the reputed high susceptibility to tuberculosis of the animals used, attention is called to the fact that guinea pigs have been repeatedly shown at the Experiment Station of the Bureau of Animal Industry to be quite resistant to tuberculous infection unless the tubercle bacilli are injected directly into their bodies.[b c d] In one experiment 7 healthy cattle and 98 guinea pigs were exposed simultaneously for a period of about half a year to 3 tuberculous cows. The exposure was so severe that 6 of the 7 cattle contracted tuberculosis, but 97 of the guinea pigs remained healthy.

A clear conception of the danger to which public health is exposed through the use of food products derived from tuberculous dairy herds requires that we should have some knowledge of the following special subjects, which will be discussed in order: (1) The character of tuberculosis as a disease of cattle; (2) the manner in which tubercle bacilli are expelled by tuberculous cattle; (3) the general appearance of tuberculous cattle that expel tubercle bacilli; (4) how tubercle bacilli from cattle get into milk and other dairy products; (5) the virulence and vitality of tubercle bacilli in dairy products; (6) the proportion of tuberculous cows among those in use for dairy purposes; and (7) the frequency with which dairy products have been proven under existing conditions to contain tubercle bacilli.

THE CHARACTER OF TUBERCULOSIS AS A DISEASE OF CATTLE.

Tuberculosis of cattle, as of persons, may be acute and rapidly progressive and run its course quickly from infection to death. This is rare, however. As a rule it is insidious, chronic, and slowly progressive, and the bodies of its victims are able to adapt or adjust

[a] Review in Hygienisches Centralblatt, Vol. IV, No. 11, p. 322, 1908. (Reference from the Wiener Klinische Wochenschrift, vol. 20, No. 38, pp. 1144–1150, 1907.)

[b] Twentieth Animal Report, Bureau of Animal Industry, 1903, pp. 61–68.

[c] Twenty-first Annual Report, Bureau of Animal Industry, 1904, pp. 44–65.

[d] Bulletin 86, Bureau of Animal Industry, 1906, pp. 7–9.

themselves to the gradually increasing destructive changes that it causes until quite extensive harm has been done or vitally important organs have become seriously involved. The result is that the disease

Fig. 7.—Section of a tuberculous lung from a cow, showing cavity formation and thickening of interlobular connective tissue. The cavities have dense connective-tissue walls and represent the closest approach in the lungs of cattle to the cavity formation that is of common occurrence in the tuberculous lungs of persons.

may be present in the body a long time without external manifestations of its existence. It may attack any part of the body singly

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and remain confined to it, or it may attack several or many parts simultaneously or successively. Its favorite location in the bodies of cattle, as in those of persons, is the lung.

The tuberculous lungs of cattle do not show the decided cavity formation seen in human tuberculous lungs, but cavities in direct communication with the exterior of the body through bronchial tubes and more or less completely surrounded by heavy, dense, connective-tissue walls are common. The dissimilarity of the lesions in the lungs of persons and in those of cattle are no doubt the result of normal anatomical differences. The lungs of cattle, unlike those of persons, have very decidedly outlined lobules, which are bounded by webs of loose, elastic connective tissue. This tissue is so abundant that it admits of a serous and cellular infiltration through which the lobules may be separated from each other as much as one-sixteenth or even one-eighth of an inch, and consequently not only pulmonary tuberculosis but most lung diseases of cattle and other ruminants have a special, distinct character.

Figure 7, which is from a photograph of a section of a tuberculous lung of a cow, shows the character of cavity formation and the thickening of interlobular connective tissue as they occur in cattle. Even where the interlobular tissue is not greatly thickened by the tuberculous processes it can be seen in the form of fine lines bordering the individual lobules.

Tuberculosis is more effectually concealed in the bodies of cattle than in those of persons, and we all know how long a diagnosis with persons may remain in doubt. Perception, or the faculty to receive impressions, is keenest where the nervous system has the highest development. Persons, though their perception of pain is much keener than that of lower animals, complain little during the earlier stages of tuberculosis, because, we may assume, they experience little pain or distress during those stages. Cattle, with their lower perception and comparatively insignificant means to express suffering, give no indication of any pain and distress that tuberculosis may cause them.

The frequency with which tuberculous subjects cough depends largely upon perception, or sensations in their lungs and throats that prompt them to cough. Cattle shown on autopsy to have extensive, advanced, tuberculous lesions of the lungs, though observed long periods of time before their death, were found to cough only a little more frequently than cattle shown on autopsy to have healthy lungs. When tuberculous cattle cough it is usually a single, accelerated expiratory effort, or at most two or three such efforts in succession, which are sufficient to raise the material that has accumulated in their larger air passages far enough into their mouths to be swallowed. Expectoration, which is common with persons, does not occur in cattle, and paroxysms of sustained coughing, also common with persons, are

very rare in cattle and occur only during the last stages of pulmonary tuberculosis.

The bodies of all animals are stronger and more capable, as a whole as well as in their individual parts, than the ordinary vicissitudes of life require them to be. The difference between the actual strength and capability and that ordinarily required is known as the factor of safety. The rarely interrupted, placid routine of a cow's life enables her to derive full benefits from the factors of safety in her body when she becomes affected with a slow, chronic disease, such as tuberculosis, the lesions of which are circumscribed in the sense that they do not

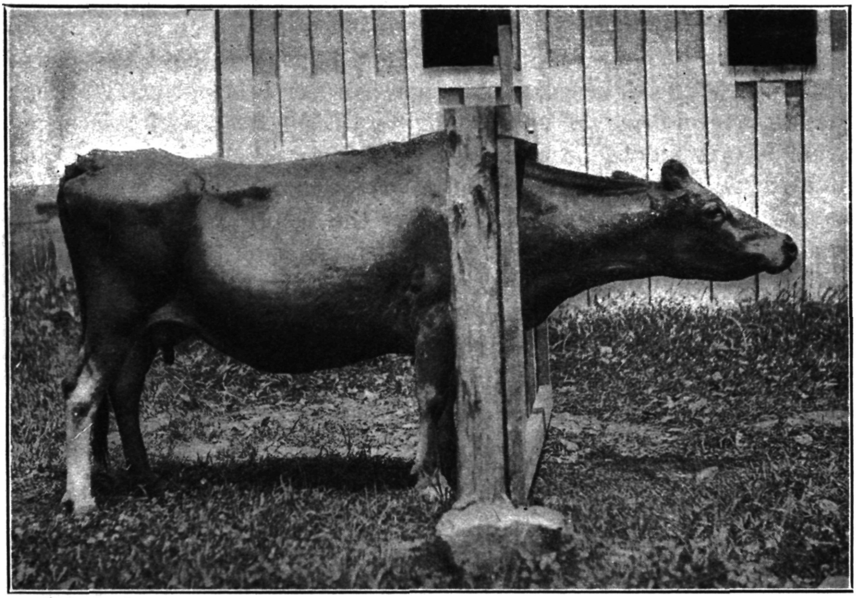

FIG. 8.—A cow affected with advanced tuberculosis. The disease is partly located in the lymph glands of the throat, as is shown by the position of the head. The glands are so much enlarged that, through pressure on the larynx, they greatly narrow the orifice through which air reaches the lung; and yet the visible bodily condition of the cow has remained very good, and is better than that of most dairy cows.

seriously affect parts of the body remote from those in which they are located; hence the factors of safety greatly help to prevent tuberculous disease in the bodies of cows from showing itself by external symptoms. An example of this is seen in figure 8, which shows a cow affected with advanced tuberculosis.

The tuberculous disease of the cow represented in the picture is partly located in the glands of her throat; the enlarged glands press on and narrow the passage through which air reaches her lung to such an extent that she almost dies of suffocation when she is driven a short distance at a moderately fast walk. The general condition of the cow shows that the opening through which the air she breathes

must pass to her lung is still large enough for ordinary purposes; the difference between its original and its present size is a factor of safety that has been almost wholly lost.

Illustrations of factors of safety, comparable to the difference between the normal and the vitally necessary caliber of the orifice in a cow's throat through which the air needed to sustain life must pass, could be given for every organ in the body. The lung, for example, is an absolutely essential organ, but post-mortem examinations often reveal conditions that prove conclusively that an animal may retain an external semblance of health when fully half of the lung tissue has been destroyed. The destruction of both kidneys would speedily cause death, but under ordinary conditions one kidney can properly do the work of both, just as good vision is possible after the loss of one eye and good hearing after one ear has become deaf through disease or accident. If it were not for liberal factors of safety, unusual efforts would be dangerous and very likely disastrous, and many diseases now regarded as of no great importance would be apt to have a fatal termination. The larger the factors of safety are, the greater is the power of an organism to overcome the adverse influences of its environment; and the more even and placid an animal's life is, the greater the destructive agencies must be that are required to break down the factors of safety to a degree that will cause manifest distress or symptoms of disease.

We may conclude that, with few exceptions, the character of tuberculosis among cattle is that of an effectually concealed disease, the detection of which, before it is well advanced and has done great harm, is practically impossible through the agency of our unaided powers of observation.

Fortunately we have in the substance known as tuberculin an excellent agent for detecting tuberculosis in live cattle when all other means of diagnosis fail.

THE MANNER IN WHICH TUBERCLE BACILLI ARE EXPELLED BY TUBERCULOUS CATTLE.

Examinations made at the Experiment Station of the Bureau of Animal Industry have shown that tuberculous cows expel tubercle bacilli more commonly with their feces than in other ways.[a] They also expel them with material drooled and slobbered from their mouths during feeding and ruminating, with the particles of fluid sprayed from their mouths and noses during accelerated expiratory acts, and directly with their milk when their udders are affected. Some authorities assert that tubercle bacilli are expelled directly with the milk when the udder is free from disease, but the observations at

[a] Bulletin 99, Bureau of Animal Industry.

the Experiment Station indicate that this does not occur unless cows are affected with otherwise generalized, advanced tuberculosis.

The British Royal Commission on Human and Animal Tuberculosis has proven by careful tests that cows affected with advanced tuberculosis may expel tubercle bacilli directly with their milk when no tuberculous lesions can be detected in their udders on post-mortem examination,[a] and De Jong reports that he found three among ten apparently healthy, slightly affected tuberculous cows that were passing tubercle bacilli through healthy udders.[b]

Milk infected directly through the udder is exceedingly dangerous, because the tubercle bacilli it contains are apt to be numerous and are of the freshest and most virulent kind. Prof. V. A. Moore, of Cornell University, says:

> It has been shown from all examinations that have been reported of milk from tuberculous cows that about 15 per cent of them give off tubercle bacilli with their milk during the course of the disease. The udders show tuberculosis in about 2 per cent of the cases.[c]

The frequency with which the udders of tuberculous cows are affected is difficult to determine, as is very well shown by the observations of the Experiment Station. For a period of about ten years only 1 per cent of the tuberculous cattle examined were found to have tuberculous udders, while, on the other hand, among the tuberculous cattle examined during the last three or four years fully 6 per cent were found with tuberculous udders. The percentage given by Professor Moore is no doubt very near the truth.

The number of tubercle bacilli expelled from the mouths and noses of tuberculous cattle is probably not as great as the number expelled under parallel conditions of disease from the mouths and noses of tuberculous persons, because cattle cough less frequently and less violently and do not spit. The tubercle bacilli that are expelled with the feces per rectum have their origin in the lung more commonly than elsewhere. They are raised into the mouth and swallowed, and on their way through the intestinal tract become evenly mixed with the material that is ejected as feces from the bowels. The result is that the large amount of feces passed by cows—about 30 pounds a day by a cow of average size—introduces an enormous amount of infectious material into their environment when they are affected with tuberculosis, much more than can be safely and economically disposed of so as to make this environment a proper place for the exposure of human food.

As the discovery of virulent tubercle bacilli in the feces of tuberculous cattle is of comparatively recent date, and as some harmless

[a] Third Interim Report, London, 1909.

[b] Fortschritte der Medizine, vol. 26, No. 26, Sept. 20, 1908.

[c] Bulletin 250, Cornell University, January, 1908.

bacilli closely resembling tubercle bacilli in appearance are of common occurrence in and about stables, and are supposed to be of common occurrence in the feces of cattle, it is desirable to outline briefly the evidence on which the occurrence of virulent tubercle bacilli in the feces of tuberculous cattle rests.

1. Microscopic examinations of the feces of a cow that was being fed small amounts of tubercle bacilli, in the form of cultures added to her drinking water, revealed germs precisely like tubercle bacilli. The cultures of tubercle bacilli fed to the cow were of a virulence too low to cause tuberculosis in cattle. The test of the bacilli in the feces showed that they were virulent for guinea pigs. This experiment proved that tubercle bacilli can pass through the entire length of a cow's intestinal tract and out with her feces without losing their pathogenic virulence.

2. Numerous microscopic examinations made with the feces of tuberculous cows and with the feces of healthy cows, stabled, fed, and generally kept under precisely the same conditions, revealed that the feces of the tuberculous cows contained bacilli like tubercle germs and that the feces of the healthy cows did not contain such bacilli.

With the exception of a few cases, the tubercle bacilli were not a constant factor in the feces of the tuberculous cows; their occurrence varied from cases in which they were found with every examination to cases in which they were found, with daily examinations, only once every two to three weeks. This intermittent character of the expulsion of tubercle bacilli in the feces is precisely what should be expected when we bear in mind that the bacilli usually have their origin in the lung; that tuberculosis in the lungs of cattle, because of the abundant interlobular connective tissue, is not accompanied by free cavity formation, and that cattle do not cough as freely or as violently as persons affected with lung tuberculosis.

3. Guinea pigs inoculated with small amounts of fresh feces from tuberculous cows that were passing bacilli like tubercle germs per rectum became affected with typical, generalized, fatal tuberculosis.

4. Cultures made from the bodies of guinea pigs that succumbed to tuberculosis induced by the inoculation of fresh feces from tuberculous cows were found to be pure cultures of tubercle bacilli, and such pure cultures were proved to be virulent for cattle. In one instance a cow inoculated subcutaneously with a culture of this kind became affected with rapidly progressive, generalized tuberculosis, which terminated in death after a few months.

5. Hogs fed with the feces of tuberculous cows contracted typical tuberculosis. The feces were collected under conditions which insure that no infectious material was introduced into them that did not pass from the bowels of the cows.

The expulsion of tubercle bacilli by cattle per rectum with their feces is one of the most important causes of tuberculosis among hogs, as we may judge from figure 9, which represents a common farm scene—a herd of hogs in a hog yard adjacent to a cow stable. The cow stable in this instance contains a herd of tuberculous cattle; the cattle are not permitted to enter the hog yard and the hogs are not permitted to enter the cow stable or the field in which the cows pasture. More than half the hogs that remain in the hog yard and root in the manure pile contract tuberculosis within six months.

All the hogs exposed to the infected manure in this experiment were carefully tested with tuberculin before they were turned into the hog yard, and no tuberculous hogs or other tuberculous animals

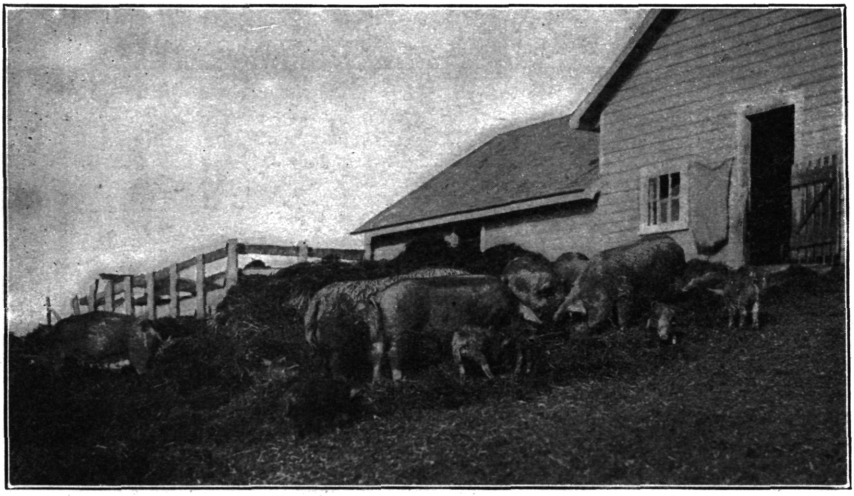

FIG. 9.—A common method by which hogs contract tuberculosis from cattle. The hogs are rooting in a manure pile in a hog yard adjacent to a cow stable containing a herd of tuberculous cattle More than half of the hogs confined in the yard contract tuberculosis within six months.

at any time occupied the yard excepting those that contracted the disease through exposure to the manure pile. A noteworthy fact about the hogs born in the yard is that, as far as could be determined, they rarely contracted the disease until after they were weaned.

The relative frequency with which tuberculous cows expel tubercle bacilli per rectum has not been accurately determined. Among 12 cows, collected from several dairy herds for use in an investigation in which a number of apparently healthy but tuberculous cows were required, 5, or $41\frac{2}{3}$ per cent, were found to be passing tubercle bacilli intermittently per rectum with their feces. Eighteen months later the number had increased to 10, or $83\frac{1}{3}$ per cent; that is, it had doubled, though the majority of the cows still retained their apparently good condition and showed no marked symptoms of tuberculosis.

The feces of only a small number of the cows known to have been affected with tuberculosis three years or more have been examined; it was found that these cows were all passing tubercle bacilli per rectum.

The discovery made at the Experiment Station of the Bureau of Animal Industry that apparently healthy but tuberculous cows pass large numbers of tubercle bacilli per rectum with their feces has recently been confirmed by the work of the British Royal Commission on Human and Animal Tuberculosis. The number of cows used in the commission's investigation was small, but included one fat, apparently healthy cow, the tuberculous disease of which was found on post-mortem examination to be limited entirely to the thoracic organs. The feces of this cow on inoculation into guinea pigs and rabbits caused tuberculosis.[a]

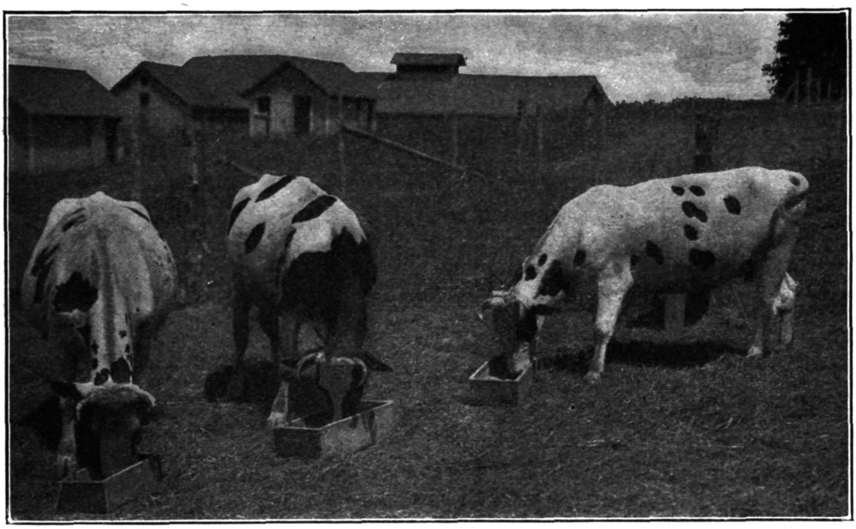

FIG. 10.—Three tuberculous cows. The two on the right expel tubercle bacilli with their feces and probably also with the material slobbered from their mouths during eating. Tubercle bacilli that are passed from the bowels of cows usually have their origin in the lung and throat, from which regions they are coughed into the mouth and swallowed. The visible condition of the cows shows nothing of their dangerous tuberculous character.

THE APPEARANCE OF CATTLE THAT EXPEL TUBERCLE BACILLI.

When we think of animals afflicted with diseases we usually picture them in our minds as showing distinct variations in their appearance and demeanor from what we regard as healthy and normal. Disease and no symptoms is almost a contradiction, and this seeming contradiction and truly paradoxical condition is one of the important facts about tuberculous cattle.

[a] Third Interim Report of the British Royal Commission on Human and Animal Tuberculosis, London, 1909.

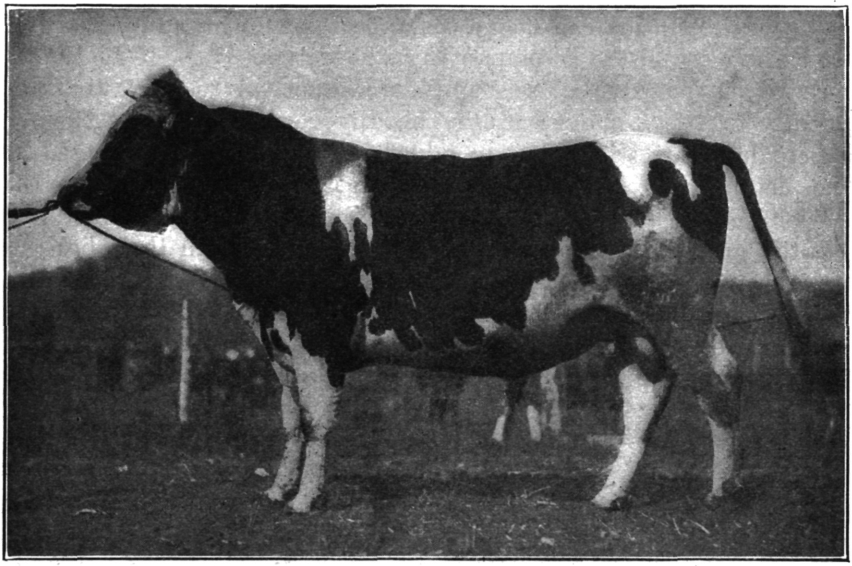

FIG. 11.—A tuberculous bull, known to pass tubercle bacilli with his feces. When tubercle bacilli can be detected in the feces they are probably numerous, because the opaque character of the material and the fact that the bacilli are isolated from each other and evenly distributed throughout the entire mass make it difficult to find them.

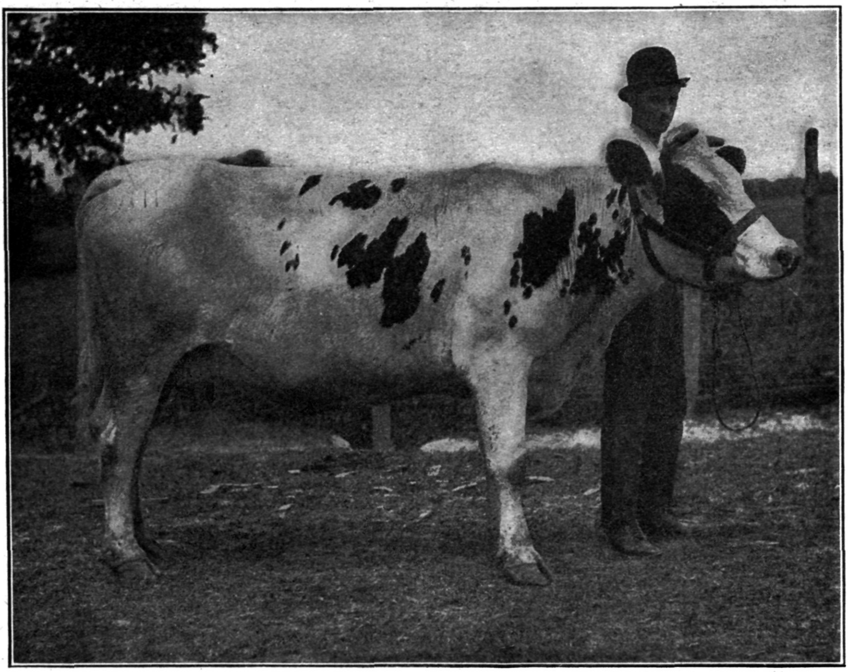

FIG. 12.—An exceptionally dangerous tuberculous cow. At the time her picture was taken she was daily passing a large number of tubercle bacilli with her feces. Her general condition is good and she shows no symptoms of tuberculosis. Without the tuberculin test she would not have been known to be tuberculous, and without other tests her uncommonly dangerous character would not have been suspected.

As no description can define the appearance of an animal as well as a photograph, the accompanying illustrations (figs. 10 to 19, inclusive), made from photographs, are presented to show the frequently excellent and seemingly healthy condition of dangerously tuberculous cattle. It must be added that the cattle represented in the pictures do not cough; they have excellent appetites and no visible or audible respiratory difficulties; in all respects they act like healthy animals, and perfect harmony exists between their healthy appearance and their healthy conduct. It is only when the tuberculin test is applied to them that their tuberculous condition is revealed, and it is only when the substances that are eliminated from their bodies—feces, saliva, milk, etc.—are subjected to microscopic and

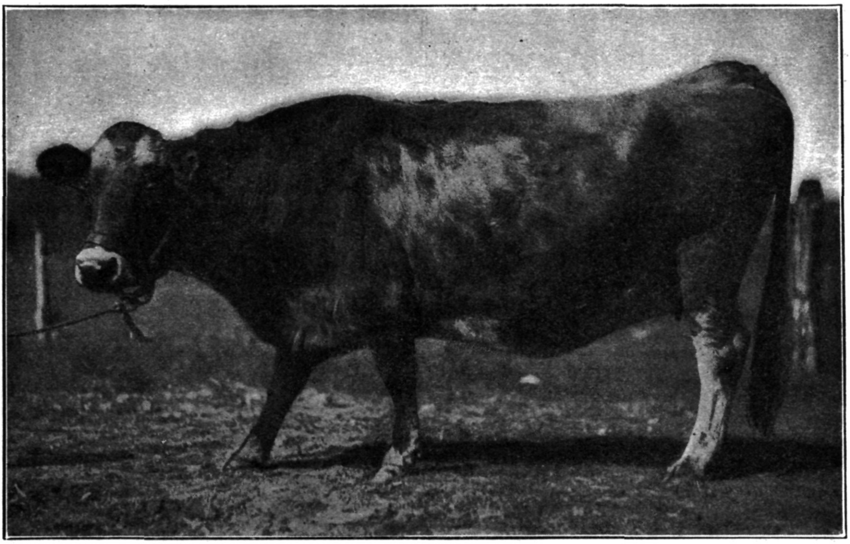

Fig. 13.—A dangerous tuberculous cow. It is known that this cow began to expel tubercle bacilli with her feces as long as eighteen months before her picture was taken. Her condition is that of a fat beef animal.

other tests that the proof is obtained of their dangerous character for public health and for the health of other animals.

It is not always possible to determine precisely how tubercle bacilli are expelled by individual tuberculous cattle; the tests for this purpose require too much time and careful observation for general practical application. It is well to assume that every tuberculous cow expels tubercle bacilli, because if she does not do so at one time she will do so sooner or later in the course of the disease.

The enormous tuberculous masses sometimes found on post-mortem examination in the bodies of cows like the subjects of these pictures cause great surprise, and demonstrate that life and seeming health

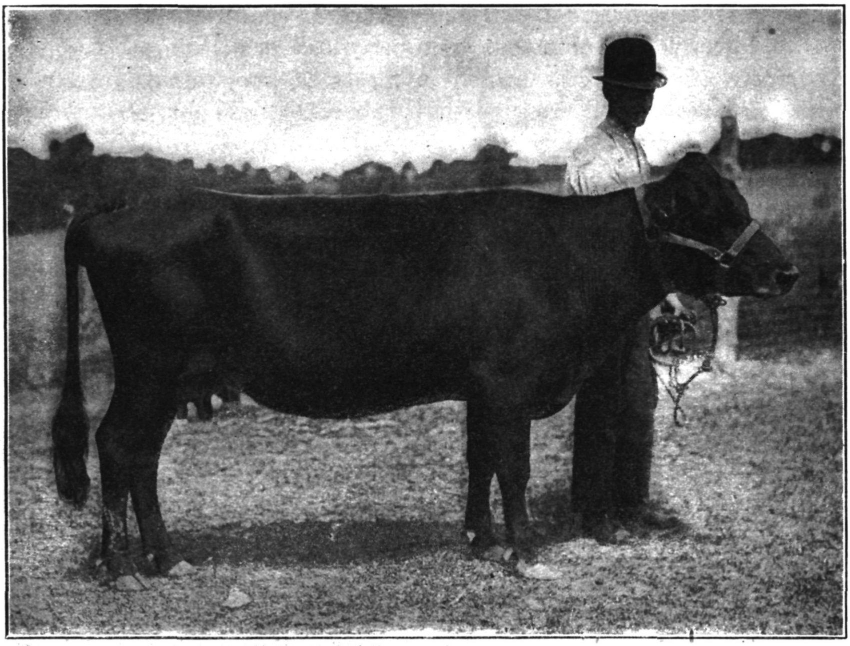

FIG. 14.—A dangerously tuberculous cow. The appearance of this animal is that of a well-kept family cow. She is dangerously tuberculous because she expels tubercle bacilli from her body per rectum with her feces.

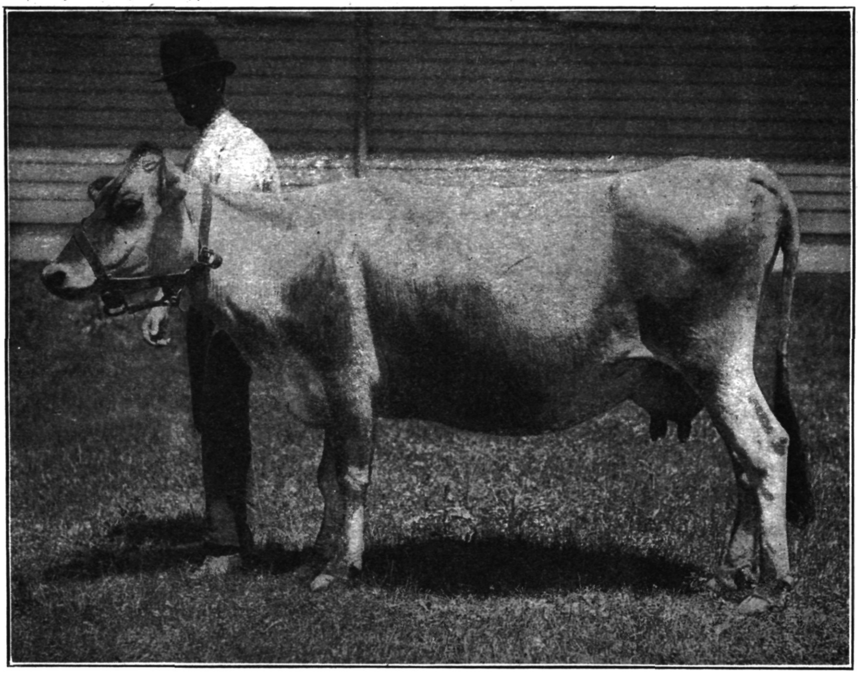

FIG. 15.—A dangerously tuberculous cow, known to pass tubercle bacilli per rectum with her feces.

can be maintained under extremely adverse conditions that are of slow and gradual development, as tuberculosis or consumption.

Directly after the cow shown in figure 16 was removed from a dairy herd because she reacted with tuberculin and not because she showed symptoms of tuberculosis, a small nodule about the size of a pea was discovered under the skin of her udder. Examination of the milk from the quarter of the udder in which the nodule was located revealed the presence of numerous virulent tubercle bacilli. The cow was permitted to live some time, because it was desirable to use her infected milk for special investigations. When she was killed her udder was found to be in the condition shown in figure 17.

FIG. 16.—An exceptionally dangerous tuberculous cow. This cow, in addition to secreting highly virulent tuberculous milk, also expelled tubercle bacilli from her mouth and per rectum.

Cattle like those shown in the illustrations supply the best proof we can obtain of the possibly dangerous character of dairy cows that are not proved by a careful application of the tuberculin test to be free from tuberculosis. These cattle are in excellent condition; most of them are in better bodily condition than can be expected of ideal dairy cows that give large quantities of milk; they show no symptoms of disease, and act precisely like normal healthy animals. A cow like the subject of figure 16 shows that tuberculous cows with tuberculous udders may remain undetected until the tuberculin test is applied to them, and a cow like the subject of figure 18 proves conclusively that apparently healthy tuberculous cows may, at any time without previous warning, suffer an acute extension of the disease to

their udders, through which their milk becomes so badly infected with tubercle bacilli that its use in a raw state would be suicidal.

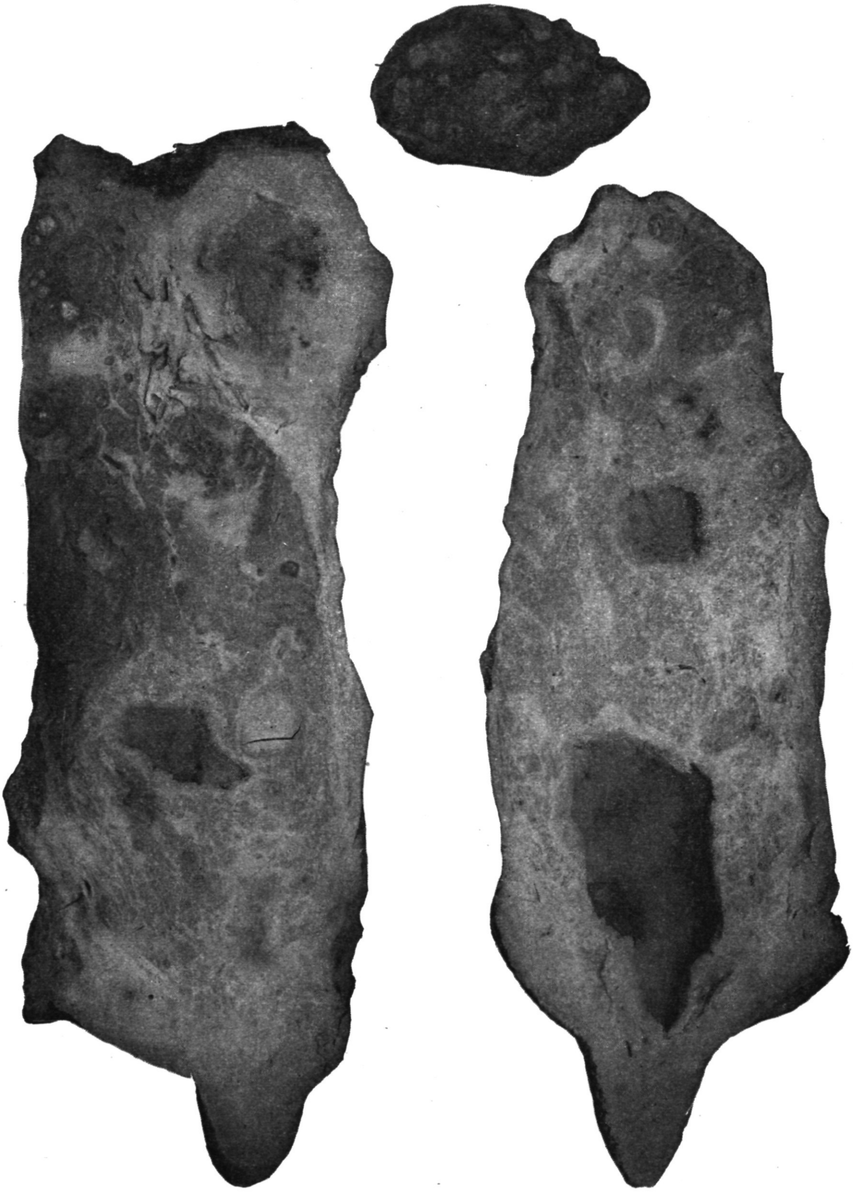

Fig. 17.—Sections of the tuberculous udder and a pubic lymph gland of the cow shown in figure 16. The pubic lymph glands are located directly behind and above the udder and usually show tuberculous lesions when the udder is affected.

We may conclude that the general appearance of tuberculous cattle, until the disease is near its last stages, or has become generalized,

or has dangerously encroached on vitally important organs, is like that of healthy cattle, and that the visibly good or bad condition of cattle is more a question of sufficient feed than of tuberculosis in its earlier stages.

There was a time when veterinarians believed themselves competent to diagnose pulmonary tuberculosis of cattle in its earlier stages by physical examination, but most veterinarians, more particularly those who have had large experience in the examination of bovine lungs by means of auscultation and percussion, are now convinced that this

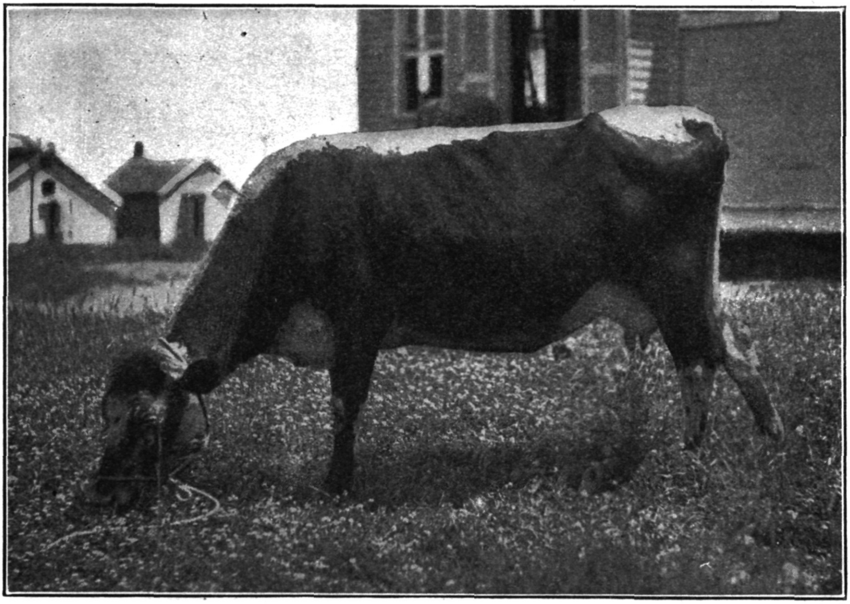

FIG. 18.—A dangerously tuberculous cow. This cow was kept under observation about two years. She expelled tubercle bacilli per rectum, but her milk remained free from infection until about two weeks before she was killed. Her udder suddenly increased enormously in size and the material obtained from it was found to contain numerous tubercle bacilli. This cow is a rare illustration of the fact that acute tuberculosis may develop suddenly in the udder of a tuberculous cow, and thus make her milk extremely dangerous. Figure 19 shows the condition of the udder as found on autopsy.

is rarely possible. The broad, flat ribs, the thick, hairy hide over the thorax, the transmission of sounds from the organs of digestion, which are enormously large because of the coarse materials ruminants eat, and the common location of tuberculous disease in the dorsal portion of the lung and in the mediastinal space where it can not be detected at all from without, are a few of the conditions in cattle that interfere with the satisfactory application of the means of diagnosis that are of high value when they are applied to the more tractable and much smaller bodies of persons.

In looking over the pictures given in this article it is desirable that the reader should bear in mind that no special effort was made

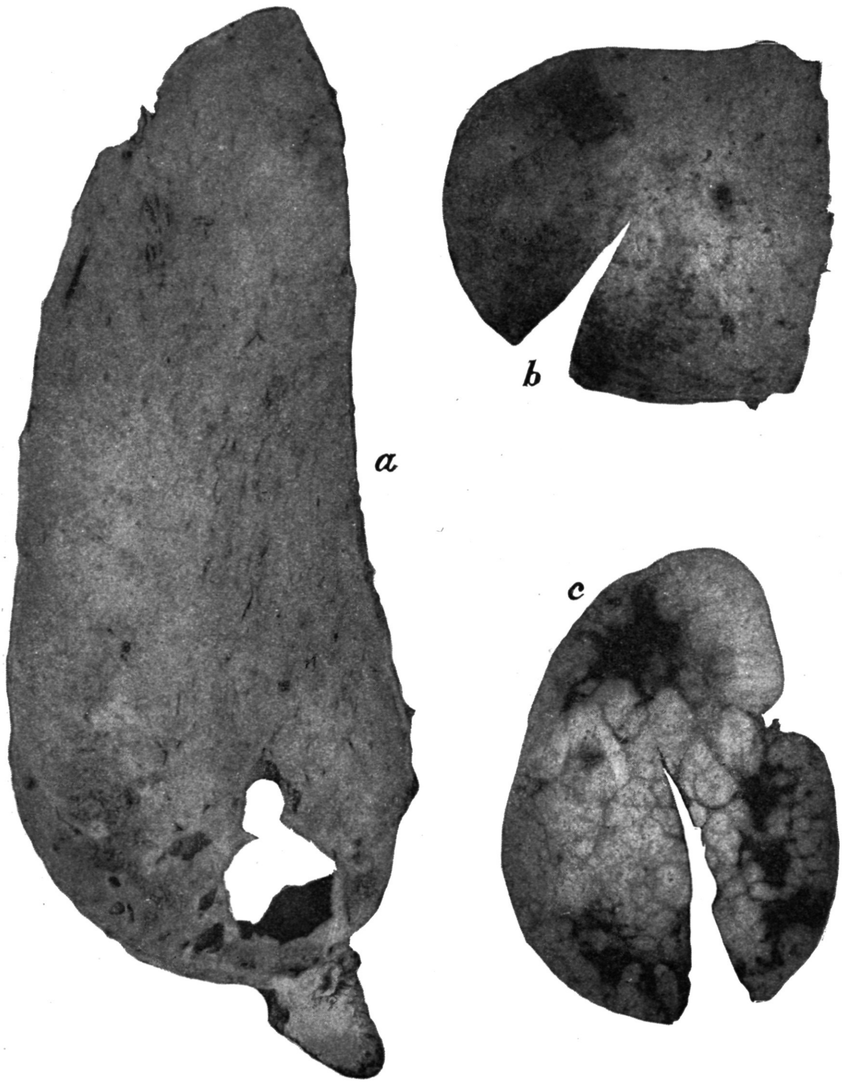

FIG. 19.—Sections of the udder and a pubic lymph gland of the cow shown in figure 18. *a*, Longitudinal section of udder; *b*, transverse section of udder; *c*, section of pubic lymph gland. The udder is affected with diffuse, very acute tuberculosis. The lymph gland is many times its normal size, and though it shows no well-marked tuberculous lesions, fluid expressed from it was found on microscopic examination to be loaded with tubercle bacilli.

to obtain photographs from many different sources so as to present exceptional conditions. All the photographs are those of animals

that were among a total of 50 tuberculous cattle received at the Experiment Station during the last three years, and among this total of 50 there were at least 25 animals that could well have been used to illustrate the excellent physical condition of dangerously tuberculous cattle and about 40 that could have been used to illustrate simply the healthy, normal appearance of tuberculous cows.

As all persons are not acquainted with the miserable appearance of the cows from which a large part of the public milk supply is derived, and as it will serve as a means to emphasize by comparison the frequently excellent condition of seemingly healthy but in fact dangerously tuberculous cattle, two pictures (figs. 20 and 21) are

FIG. 20.—A visibly tuberculous dairy cow. Such cattle expel tubercle bacilli almost without exception with their feces and with the material that is drooled, slobbered, and sprayed from their mouths. It is asserted by some authorities that they also expel tubercle bacilli directly through their udders with the milk. Cows of this kind are altogether too common in dairy herds.

presented which show by no means the thinnest and most objectionable kind of cows actually found in dairy herds.

Cows affected with tuberculosis may live, notwithstanding their diseased condition, so many years that their death, when it does come, may be attributed with some justice to the infirmities incident to old age. Two cows very much like the one shown in figure 21 were kept under observation for more than six years after it was known that they were affected with tuberculosis; they finally died at an advanced age reached by few cattle. This proves conclusively that a tuberculous cow may live many years after she has become a center for the infection of other animals and a menace to public health.

HOW TUBERCLE BACILLI EXPELLED BY TUBERCULOUS COWS GET INTO MILK AND DAIRY PRODUCTS.

It has been shown that seemingly healthy but tuberculous cows expel tubercle bacilli directly with their milk and at one end of their bodies with saliva and particles of food and at the other end with feces. Consequently we may justly conclude, if it can be shown that the material discharged by cattle by the mouth and per rectum occurs frequently as a contaminating element in commercial milk, that the milk of tuberculous cows, and also the milk of healthy cows that are stabled and milked together with tuberculous cows, will often be infected with tubercle bacilli.

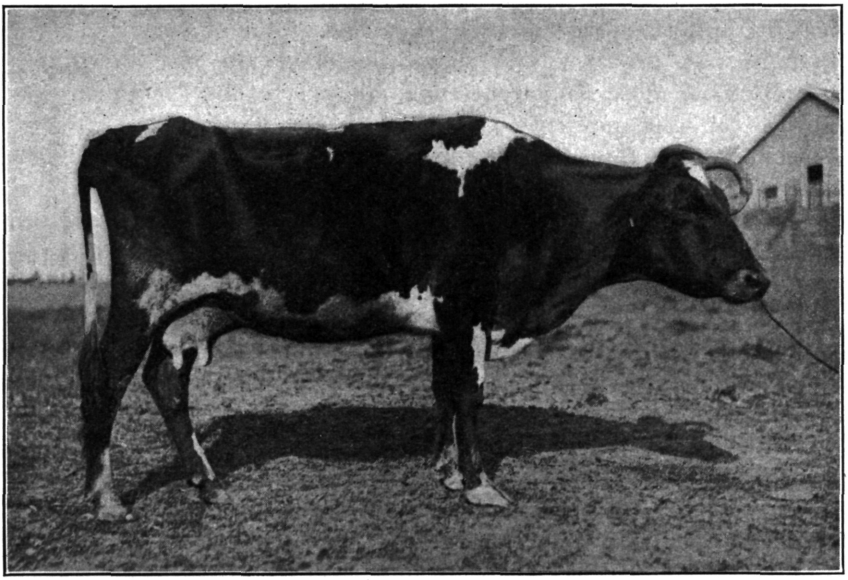

FIG. 21.—A very old and visibly tuberculous cow.

In one of the publications of the United States Public Health and Marine-Hospital Service[a] the following statement is made about the milk of Washington, D. C., which is no worse than that of other cities:

> In addition to being warm, much of the milk is dirty. Fifty-one of 172 samples examined showed no visible deposit in the original container after standing several hours. Fifteen of the samples contained a very small amount of dirt, 98 contained a small amount of dirt, 8 contained much dirt, and 1 contained (mouse?) feces.
>
> The foreign matter (dirt) when examined under the microscope was found to consist of fecal matter, hairs, epithelial and other cells, straw, bacteria, and all manner of extraneous substances that have no place in clean milk.

[a] United States Public Health and Marine-Hospital Service, Hygienic Laboratory, Bulletin 35, p. 71.

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After several hours' standing in the original containers 121 of 172 samples, or 70 per cent of the kind of milk that reaches the consumer, showed a visible deposit of dirt, which was found on microscopic examination to be made up in part of fecal matter, or that matter in which tuberculous cows most commonly expel tubercle bacilli.

At the Experiment Station of the Bureau of Animal Industry a large number of samples of milk, purchased from regular city milk dealers under ordinary market conditions, were placed in the tubes of a small centrifuge and rotated fifteen minutes at the rate of 2,000 revolutions to the minute. Every sample treated in this way deposited a sediment, and microscopic examinations of the sediment revealed that 98 per cent contained particles of vegetable matter identical in appearance with minute fragments of bovine feces.

On its face this is a very disgusting condition, but it is unfortunately even more dangerous than its superficial appearance indicates, as the solid impurities that reach the consumer in milk are only a fraction of the total solid impurities with which it has been in contact. Larger masses of feces and other larger solid impurities that drop into milk or are splashed, sprayed, or otherwise introduced into it from the environment of cows are removed by the straining to which it is subjected before it is poured into the containers in which it is sold; hence only those solid impurities that are small enough to pass through the strainer are found when samples of market milk are examined.

What this means relative to the infection of milk with tubercle bacilli when it is obtained from, or in the environment of, tuberculous cows, is a subject on which it is hardly necessary to enlarge. No firm union exists between the tubercle bacilli and the feces, throughout the entire mass of which they are evenly disseminated. The bacilli are present in an easily detached condition; they are probably washed free from the feces which find their way into the milk, and they are too small to be removed by the strainer. In a test made regarding this matter it was found that when guinea pigs were inoculated with normal fresh milk to which small amounts of fresh feces from tuberculous cows had been added—amounts no greater than commonly fall into the milk pail during ordinary milking—those inoculated after the milk had been strained succumbed to tuberculosis as rapidly as those inoculated with the milk before it was strained.

That the solid material found in milk as sediment can not be taken as a true measure of the amount of solid, foreign, contaminating material with which it has actually been in contact is shown by the following observation: Among the samples of commercial milk examined relative to fecal content a number were found, with little or no vegetable sediment, that yielded in the tubes of a centrifuge cream discolored precisely like the cream obtained from milk to which quite

large quantities of cow feces were intentionally added. Such milk, because of its freedom from sediment and its discolored cream, must be regarded as very dirty and very dangerous milk that has been exceptionally well strained.

The specific gravity of tubercle bacilli is higher than that of milk, and hence it does not seem unreasonable to suppose that they can be removed from it by sedimentation. This supposition would be true if milk were a homogeneous liquid like water, and not an emulsion. Investigations made to determine how tubercle bacilli distribute themselves in milk under different conditions proved that they adhere to the cream globules with a tenacity that can not be broken by a simple difference of specific gravity, even when this difference is reenforced by centrifugalization. The result is that when milk is allowed to stand for cream to rise, or when cream is separated from it rapidly in a centrifuge, the tubercle bacilli, when present, rise as abundantly with the cream globules as they gravitate with the sediment, and disappear from the intermediate layer or the skim milk, which is practically a homogeneous fluid. This holds true when pure cultures of tubercle bacilli are added to the milk, also when the bacilli are introduced into it with tuberculous bovine feces or pus from tuberculous abscesses, and when they are present because tuberculous lesions exist in the udder of the cow from which it was obtained.

These facts make it almost unnecessary to formulate the conclusion that cream obtained from tuberculous milk contains more tubercle bacilli, measure for measure, than the milk.

Cream is the material from which butter is made, and that butter made from infected cream has the infection transferred to it was proven by repeatedly making butter from infected cream and testing it.

That tubercle bacilli occur in cream and butter derived from milk produced by cows affected with udder tuberculosis has recently been proved by the investigations of Ostermann, who also found that tubercle bacilli are very numerous in the milk of cows that have tuberculous udders.[a]

It has been recorded that both strained and unstrained milk to which small amounts of feces from cows affected with tuberculosis were added caused tuberculosis in guinea pigs. Cream from such strained and unstrained milk also caused tuberculosis in guinea pigs, and butter made from the cream of such strained and unstrained milk likewise caused tuberculosis in guinea pigs.

In connection with the occurrence of tubercle bacilli in cream and butter it is well to bear in mind that Ravenel, who was among the

[a] Zeitschrift für Hygiene und Infektionskrankheiten, vol. 60, No. 3, pp. 410–422, 1908. (Review in Centralblatt für Allgemeine Pathologie und Pathologische Anatomie, Vol. XX, No. 1, p. 18, 1909.)

first to show that tubercle bacilli may pass through the uninjured wall of the intestine without leaving evidences of their passage and reach parts of the body remote to it, has supplied some reasons from which we may conclude that the passage of tubercle bacilli through the intestinal wall into the body is facilitated while the digestion of fat in the intestine is in progress.[a] Hence fatty substances, such as cream and butter, must be regarded as especially dangerous vehicles for the introduction of tubercle bacilli into the body, and the tendency of tubercle bacilli to cling or adhere to the cream or fat globules of infected milk may have an important significance relative to their penetration through and passage into the tissues of persons and animals.

Visibly affected tuberculous cows and cows affected with udder tuberculosis are no doubt a serious menace to public health when their milk is used raw in one form or another as human food, but as dairymen are not exceptionally unscrupulous persons and will rarely sell the milk of a visibly diseased cow, and as udder tuberculosis among cows that are not otherwise visibly diseased is rare, we may conclude that the apparently healthy tuberculous cow—the cow that intermittently expels tubercle bacilli from her body per rectum with her feces—is the most important tuberculous danger for public health that has its origin in the dairy herd. Such apparently harmless but actually dangerous cows infect not only their own milk but also the milk of other cows stabled with them, and, as we have seen, such infected milk, both strained and unstrained, equally when it is used as a beverage or as cream or as butter, contains live, virulent tubercle bacilli.

THE VIRULENCE AND VITALITY OF TUBERCLE BACILLI IN DAIRY PRODUCTS.

Less than ten years ago tubercle bacilli were grouped for all practical purposes in two classes, mammalian and avian, or those which affect man and other mammals and those which affect birds.

No one doubted openly that bacilli from cattle, in meat and dairy products, were as injurious for man as those derived from persons. Pulmonary tuberculosis, or consumption of the lungs, was then, as now, the commonest form in which the disease manifested itself, and this was explained by the assumption that the bacilli entered the body more frequently with the breath than in any other way, and that the greatest danger of infection was through dried and pulverized tuberculous material that floated in the air as fine dust.

The beginning of the present century brought a change of views. Attention was called to the fact that the inhalation theory to account

[a] Journal of Medical Research, vol. 10, No. 3 (n. s. vol. 5, whole No. 78) pp. 460–462, 1903. (Review in Zeitschrift für Tuberkulose, vol. 13, No. 1, p. 74.)

for the frequent presence of tuberculosis in the pulmonary tissues had not been proven and that living tubercle bacilli in dust were difficult to find or could not be found at all. The infectiousness of bacilli from animals for man was questioned, and the investigation of tuberculosis generally was given a fresh impetus through which many new facts and theories came to light.

As tubercle bacilli in dairy products are mainly derived from bovine sources and enter the body in a moist state, to understand the true significance they have for public health we must give some attention to the infectiousness of tubercle bacilli from bovine sources for man and to the ways in which tubercle bacilli enter the bodies of those who become affected with tuberculosis.

COMPARATIVE MORPHOLOGY AND VIRULENCE OF TUBERCLE BACILLI OF HUMAN AND BOVINE TYPES.

Since Theobald Smith[a] published his studies on different varieties of tubercle bacilli, the evidence in favor of two distinct types virulent for mammals—the one found more commonly in bovine and the other in human lesions—has grown stronger. But different varieties or types do not necessarily mean different species or even subspecies. As Smith himself stated, "Varieties have been found among nearly all of those specific forms of pathogenic bacteria which have received a considerable amount of attention."[b] The term "varieties" is here clearly used to designate differences of a kind to be expected among the individuals of a large and widespread species, such differences as we know to occur among organisms higher than bacteria and with a wide geographic distribution. There is a distinct parallelism between a wide geographic distribution of higher plants and animals and the number and kinds of hosts a pathogenic bacterium may infect; hence there is no reason why the tubercle bacillus, which has received more attention and which affects more species of animals and more individuals than any other bacterium, should not have been found to include many different types, the extremes of which would leave us in doubt as to their specific classification if they were not connected by a chain of transition forms.

Mohler and Washburn,[c] after a comparison of many tubercle bacilli from different sources and a careful search of the literature, concluded that the more the subject is studied the more numerous the instances become in which bacilli of special types are found occurring

[a] Twelfth and Thirteenth Annual Reports, Bureau of Animal Industry, 1895 and 1896. Journal of Experimental Medicine, vol. 3, New York, 1898.

[b] Twelfth and Thirteenth Annual Reports, Bureau of Animal Industry, 1895 and 1896, p. 149.

[c] Bulletin 96, Bureau of Animal Industry.

naturally in animals far removed from the species which may be supposed to be their natural host. They obtained cultures of tubercle bacilli from human lesions that were morphologically and biologically bovine types, and in their summary of the investigations of others they show that bovine types have frequently been obtained from man and human types from cattle. These investigators [a] after a prolonged study of the susceptibility of tubercle bacilli to modification draw the conclusion "that the morphology of tubercle bacilli is their most variable characteristic." They successfully changed the morphology and also the virulence of tubercle bacilli in the course of their investigations, and found it possible both to reduce and to increase the virulence of tubercle bacilli for different species of animals.

As examples of changes in morphology the following are instructive as well as interesting. A tubercle culture isolated from sputum was given a more perfect so-called "human" morphological character than it originally possessed by passing it through cats. The same culture was given a perfect so-called "bovine" morphological character by passing it through cattle. A culture isolated from a tuberculous boy was found to be morphologically a bovine type; after fifteen generations on artificial media it was still bovine in character; by passage through cats it became morphologically a human type. A culture isolated from bovine tuberculous lesions was found to be morphologically a bovine type; it became morphologically a human type by growth on solidified human blood serum. It is reasonable to assume, if human blood serum can effect this change in a morphologically bovine tubercle bacillus from a bovine source, that the residence of tubercle bacilli from bovine lesions in the human body may likewise cause a change from so-called bovine to so-called human morphology.

The morphological instability of tubercle bacilli is strikingly shown by the accompanying illustrations (Plates I, II, and III) taken from the work of Mohler and Washburn.[b] These illustrations have been rearranged by the present author for the sake of better comparison for the purposes of this article.

Plate I shows that it is possible to change tubercle bacilli from the so-called human type (which is long, relatively thin, beaded, and occasionally slightly curved) to the so-called bovine type (which is relatively short and thick and not beaded), and vice versa. Plates II and III show how surprisingly dissimilar the morphology of tubercle bacilli from different sources may be, from the thick, short germs that were obtained from a hog to the thin, beaded threads that were obtained from human sputum.

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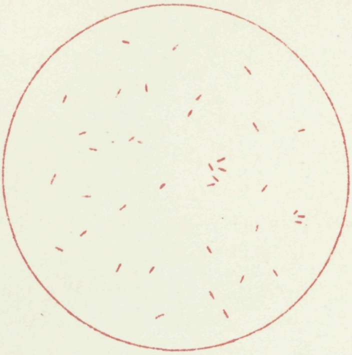
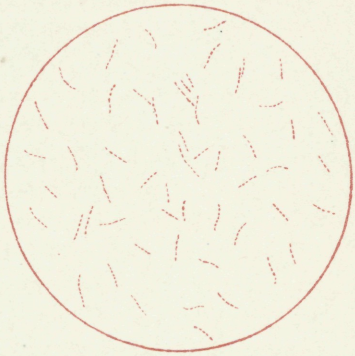
[a] Twenty-third Annual Report, Bureau of Animal Industry, pp. 113–163.

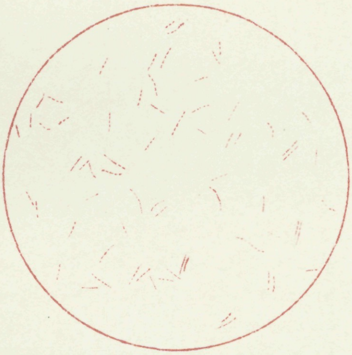
[b] Twenty-third Annual Report, Bureau of Animal Industry, 1906.



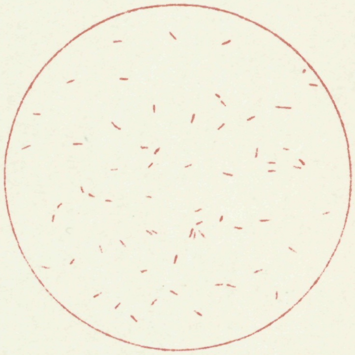
1.—Tubercle bacilli of bovine type originally obtained from cow affected with generalized tuberculosis.



2.—Tubercle bacilli shown in figure 1, changed to human type by growth on solidified human blood serum.

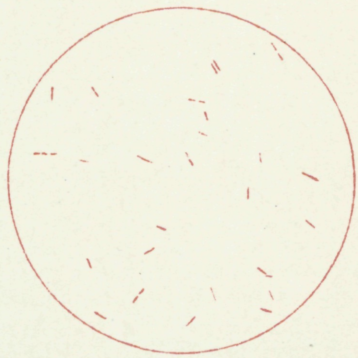


3.—Tubercle bacilli of human type originally obtained from human sputum.



4.—Tubercle bacilli shown in figure 3, changed to bovine type by passage through cattle.

5.—Tubercle bacilli of human type originally obtained from a man.



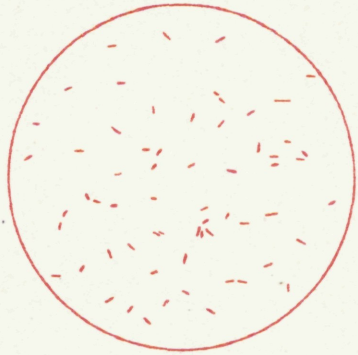
6.—Tubercle bacilli shown in figure 5, changed to bovine type by passage through a sheep.

EXAMPLES OF THE CHANGEABILITY OF TUBERCLE BACILLI FROM HUMAN TO BOVINE TYPES AND VICE VERSA.

A.B. GRAHAM CO. LITH. WASH. D.C.

HUMAN TYPES. BOVINE TYPES.

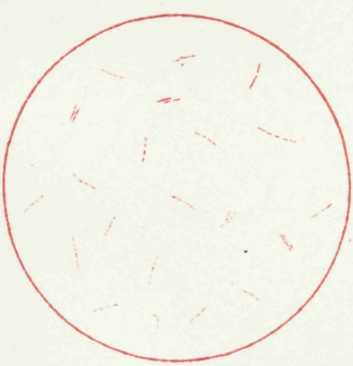
Man (sputum).



Man (sputum).

Girl.

Boy.



Cow.

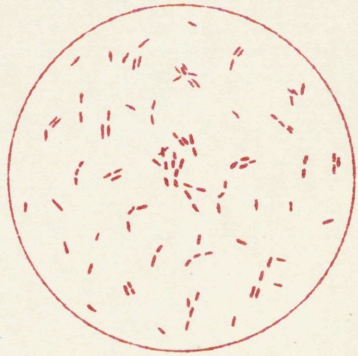
Cow.

TUBERCLE BACILLI OF HUMAN AND BOVINE TYPES FROM SIMILAR SOURCES.

(The original source is named under each figure.)

HUMAN TYPES. BOVINE TYPES.

Monkey.

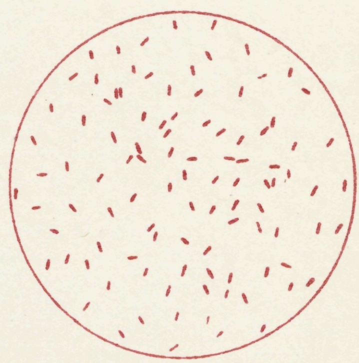


Monkey.

Deer.

Deer.

Peccary
(a wild hoglike animal).



Hog.

TUBERCLE BACILLI OF HUMAN AND BOVINE TYPES FROM SIMILAR SOURCES.

(The original source is named under each figure.)

The tubercle bacilli shown in the illustrations were all stained in the same manner with carbol-fuchsin and decolorized with 20 per cent sulphuric acid. They were drawn with a camera lucida and are magnified about 900 diameters.

Mohler and Washburn are not the only investigators who have obtained results to prove that tubercle bacilli may be made to vary in morphology and virulence. In their work they give a history of investigations similar to their own, which strengthens the evidence for the conclusion that we can find nothing in the morphology and virulence of tubercle bacilli to encourage us to underestimate the danger to the public health of those from bovine sources.

Fibiger and Jensen,[a] who likewise obtained from human lesions typical bovine bacilli virulent for cattle, recall that the Imperial German Health Office examined 39 cases of primary tuberculosis of the human intestines and mesenteric glands, and found that 13 among them were caused by bacilli of the bovine type. Later investigations made by Fibiger and Jensen are summed up as follows:

> Though bovine types of tubercle bacilli are more commonly isolated from bovine lesions and human types from human lesions, there are cultures that must be considered as transition forms, as they have some of the characteristics of bovine and others of the human type.[b]

Gorter,[c] after a careful study of tubercle bacilli from human and bovine lesions, found 7 among 21 cultures from human sputum, which he regards as identical with the transition forms between human and bovine bacilli, which he says are described by Rabinowitsch. He concludes that human and bovine bacilli are not different varieties and that the conversion of the one type into the other actually occurs.

Dr. Nathan Raw, of Liverpool, asserted that the tubercle bacillus of the bovine type is commoner in the tuberculous lesions of children than in those of adults, and that it is introduced into the body with milk.[d] He believes that "man is attacked by two distinct types of tubercle bacilli, one conveyed by infection from person to person, the other by receiving into the body bovine bacilli from infected food."

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[a] Berliner Klinische Wochenschrift, vol. 44, Nos. 4 and 5, pp. 93–96, 134–137, 1907.

[b] Presented at the joint session of Sections I and VII of the International Congress on Tuberculosis, Washington, D. C., 1908.

[c] Review in Zeitschrift für Tuberkulose, Vol. XI, No. 3, pp. 260–261, 1907. Also review in Internationales Centralblatt für die Gesamte Tuberkulose-Forschung, Vol. II, No. 1, pp. 12–13, 1907.

[d] Review of the Sixth International Tuberculosis Conference at Vienna, September, 1907, in Centralblatt für Bacteriologie Parasitenkunde und Infektionskrankheiten, Vol. XLII, Referate, Nos. 4–6, p. 98, 1908.

In a paper read at the International Congress on Tuberculosis at Washington in 1908 he made the following statement:

> Prolonged and careful experimental research has demonstrated beyond doubt that the contention of Koch was right when he affirmed that human and bovine tuberculosis were not identical, but it has been demonstrated that the great scientist was in error when he said that bovine tuberculosis could not be communicated to the human.[a]

The two distinct types of bacilli recognized by Raw, as we have seen, are directly connected by transition forms, and are, as we have also seen from the work of Mohler and Washburn and others, convertible each into the other.

Eber, of Leipzig, studied tubercle bacilli derived from 8 fatal cases of human tuberculosis. The 8 strains of bacilli obtained were found on inoculation to be, 2 strongly virulent, 2 slightly virulent, and 4 nonvirulent for cattle. The several strains were recovered from the tissues of the inoculated cattle and retested, and it was found that the 2 slightly virulent had become strongly virulent and that 2 of the nonvirulent had become slightly virulent for cattle. Eber concludes from this that an attempt at a sharp differentiation of the tubercle bacilli that occur in human tuberculous lesions into those that are and those that are not virulent for cattle soon encounters difficulties.[b]

As the recovery of tubercle bacilli from animals into which they were injected and for which they proved nonvirulent is referred to in Eber's work, it may be well to call attention to the fact that even those strains of tubercle bacilli that have the lowest virulence for cattle cause marked local lesions when they are introduced into the tissues of cattle, and can be recovered from such lesions many months afterwards. In a study made at the Experiment Station of the Bureau of Animal Industry relative to the persistence of tubercle bacilli of a virulence too low to cause a progressive tuberculosis in the tissues of cattle after injection, a heifer was injected with tubercle bacilli isolated from human tuberculous lesions. A year and a half later the heifer was killed and examined post-mortem. No lesions of disease were found excepting a small abscess at the seat of injection. The abscess was known to exist during the life of the animal; it was largest several months after the injection was made, and was gradually reducing in size. At the post-mortem examination it was found to contain a small amount of creamy pus, which under the microscope revealed the presence of tubercle bacilli. The bacilli were proved to

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[a] Paper read at joint session of Sections I and VII, International Congress on Tuberculosis, Washington, D. C., 1908.

[b] Zeitschrift für Infektionskrankheiten, Parasitäre Krankheiten und Hygiene der Haustiere, vol. 4, Nos. 5–6, pp. 374–412. Review in Zeitschrift für Tuberkulose, vol. 13, No. 5, p. 450.

be virulent for guinea pigs, in which, on inoculation, they caused generalized tuberculosis.[a]

Even dead tubercle bacilli may persist and remain intact a long period of time in the bodies of animals, as was shown in the study above referred to, by injecting dead tubercle bacilli into the jugular vein of a sheep and finding a miliary tuberculosis of the lung six months later. The tubercles in the sheep's lung were associated with tubercle bacilli of typical appearance, and the bacilli were proved to be dead by inoculating guinea pigs with lesions from the diseased lung without causing tuberculosis.

L. Rabinowitsch examined 45 monkeys that succumbed to tuberculosis in the zoological garden of Berlin. From 33 of them cultures were obtained and found on study to be of the following types: Twenty-five human, 3 bovine, 2 transition forms between human and bovine, 1 avian, and 1 a transition form between human and avian. One monkey was found to have tuberculosis of the lung associated with tubercle bacilli of the human type and tuberculosis of the spleen associated with bacilli of the bovine type. Rabinowitsch[b] justly feels strengthened in her earlier views regarding tubercle bacilli of different types, and she has clearly demonstrated that monkeys, or the higher types among the lower animals, may contract tuberculosis alike from exposure to infectious tuberculous material that has its origin in tuberculous persons, tuberculous cattle, or tuberculous birds.

De Haan experimentally proved the infectious character of avian tubercle bacilli for monkeys, which Rabinowitsch discovered through her examination of the monkeys naturally or spontaneously afflicted with tuberculosis in the zoological garden of Berlin,[c] and M. Koch and Rabinowitsch proved that naturally contracted tuberculosis among birds is at times due to tubercle bacilli of the undoubted human type.[d]

Sorgo and Suess[e] showed that mutations occur in human tubercle bacilli and in other types, which speaks against grouping tubercle bacilli from animals of different species as special varieties.

Von Behring,[f] who ranks as one of the most widely recognized authorities on tuberculosis, found cultures of tubercle bacilli isolated

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[a] Bulletin 52, Part III, Bureau of Animal Industry, pp. 115–120.

[b] Review in Hygienisches Zentralblatt, Vol. IV, No. 11, p. 324, Oct., 1908, of article in Virchows Archiv, 1907, Supplement to vol. 190, pp. 196–245.

[c] Deutsche Medizinische Wochenschrift, 1908, vol. 34, no. 32, pp. 1386–1387. (Review in the Internationales Centralblatt für die Gesamte Tuberkulose-Forschung, Vol. III, No. 2, p. 61, 1908.)

[d] Review in Hygienisches Zentralblatt, Vol. IV, No. 11, pp. 324–325, of article in Virchows Archiv, 1907, Supplement to vol. 190, pp. 246–541.

[e] Centralblatt für Bacteriologie, etc., Abt. 1, Orig., Vol. XLIII, pp. 422–432; 529–547.

[f] Berliner Tierärztliche Wochenschrift, No. 47, pp. 725–730, 1902.

from man of low virulence for cattle, and others of higher virulence for them than many cultures of bovine origin. He declares himself opposed to the view that bovine tubercle bacilli may be harmless for man, and calls attention to the fact that they generally have a higher grade of virulence than human bacilli, and are therefore to be regarded as more dangerous.

The British Royal Commission on Human and Animal Tuberculosis [a] concluded from its investigations that cows' milk containing bovine tubercle bacilli is clearly a cause of tuberculosis—and of fatal tuberculosis—in man, and that a very large portion of tuberculosis contracted by ingestion is due to tubercle bacilli of bovine origin.

Dr. J. Bartel, of Vienna, in a paper on "The Route of Infection," said at the International Congress on Tuberculosis at Washington, D. C., 1908: "As far as we can judge at this time, the infection from pharynx, stomach, and intestines is far more frequent, particularly during early life, than has generally been considered." [b]

The nearly unanimous opinion of the members of the International Congress on Tuberculosis at Washington in 1908 was that the tuberculous dairy cow is a serious menace to public health.

It does not seem necessary to add, as could easily be done, to this evidence to prove that the various existing types of tubercle bacilli are simply mutation forms of one specific organism. The presence of transition forms between human and bovine types, the occurrence of pure bovine types in human lesions and of human types in bovine lesions, the occurrence of bacilli highly virulent for cattle in human lesions, the generally greater virulence of bovine types for all species of animals, and the greater virulence of bovine types for anthropoid apes and monkeys [c] [d]—the animals in the zoological scale most nearly related to man—are all facts that support the conclusion that tubercle bacilli in dairy products are virulent for man and are a source of great danger to public health.

FALLACY OF THE INHALATION THEORY.

It is true that tuberculosis is more commonly a disease of the lung than of other portions of the body. The explanation for this, which was long regarded as satisfactory and is still accepted by many, rests on the assumption that the most important source of tuberculous infection is finely pulverized tuberculous material, suspended in the air as dust, and the direct exposure of the lung to this dust through the

[a] Journal Royal Institute of Public Health, Vol. XV, No. 3, pp. 168–171, 1907.

[b] Paper read before Section I, International Congress on Tuberculosis, Washington, D. C., 1908.

[c] Report of the British Royal Commission in the British Medical Journal, No. 2430, 1907.

[d] Bulletin 52, Bureau of Animal Industry, 1905.

process of respiration. If this so-called inhalation theory is true, and if, as many of those who maintain it assert, tubercle bacilli can not pass through the uninjured wall of the digestive tract and reach organs remote to it without leaving evidences of their passage, then tubercle bacilli in dairy products have relatively a low significance for public health. Therefore, to prove that tubercle bacilli in dairy products are dangerous we must give some thought to the mode of infection, or the portal through which the bacilli enter the body.

How strongly the inhalation theory was intrenched in the minds of medical men is well expressed by Aufrecht[a] in the statement that considerable courage was required only a few years ago to characterize it as an unwarranted hypothesis for the wide belief of which no satisfactory evidence had been supplied. He, in 1900, and Baumgarten,[b] in 1901, pointed out that it had not been proven to be the exclusive or even the most important mode of infection with tuberculosis. In 1902 followed the experiments of Nicolas and Descos,[c] confirmed by those of Ravenel[d] in 1903, which proved that tubercle bacilli introduced into the healthy intestinal canal of animals rapidly passed through the uninjured mucosa and appeared in the great thoracic duct on their way to the venous circulation. Nocard and his pupils Desoubry and Porcher[e] had earlier shown that the passage of bacteria through the normal intestinal wall and their transference to the blood was possible. Chauveau,[f] in view of the constantly accumulating evidence that pulmonary tuberculosis in man and in animals arises from infection through the intestine, called attention to his investigations made from 1868 to 1874, in which pulmonary tuberculosis was brought about by the ingestion of tuberculous material without the production of pathological conditions in the digestive tract.

This earlier work was followed rapidly by other investigations, which proved more and more conclusively that the introduction of tubercle bacilli into the body with food may lead directly to the development of pulmonary tuberculosis, without lesions in the alimentary canal and without intermediate lesions of disease between the digestive and the respiratory organs. The most important investigations are probably those of Calmette and his associates, now

[a] Berliner Klinische Wochenschrift, vol. 44, No. 27, pp. 829–835, 1907.

[b] Wiener Medicinische Wochenschrift, vol. 51, No. 44, pp. 2050–2051, 1901.

[c] Journal de Physiologie et de Pathologie Générale, Vol. IV, 1902.

[d] Journal of Medical Research, Vol. X, No. 3, pp. 460–462, 1903.

[e] Comptes Rendus Société de Biologie, Vol. XLVII (ser. 10, vol. 2), pp. 101–104, 1895.

[f] Review in Experiment Station Record, U. S. Department of Agriculture, Vol. XIX, No. 2, p. 182, 1907. (Comptes Rendus Academie des Sciences, vol. 144, pp. 777–783. Paris, 1907.)

published in book form.[a] These investigators claim, and present good evidence in support of their claim, that dust particles never penetrate deeper into the lung than the first branches of the bronchi; that tuberculosis is constantly a disease of which the infection enters through the intestines; that tubercle bacilli may penetrate the intestinal wall without causing lesions; that the bacilli may pass through the mesenteric glands without causing lesions; that the bacilli frequently cause primary lesions in the mesenteric glands of young experiment animals, but commonly pass through these glands of adult animals and cause primary pulmonary tuberculosis, and that tuberculous processes in the lung never begin in the bronchi or alveoli, but constantly in the capillaries, especially in the finest capillary network of the subpleural tissue, etc.

Relative to this localization of the earliest stages of pulmonary tuberculosis, Aufrecht[b] says: "The initial changes in the apices of the lung, as I have convinced myself by repeated anatomical examinations, do not spread from the terminal branches of the bronchi." He further says that he has "proven the cheesy tubercle in the lung to be associated not with the finer branches of the air tubes, but with the terminal capillaries of the pulmonary arteries." While he is not a special advocate of the intestinal way as the sole mode of infection, he ends his article here referred to with these words: "The inhalation theory for lung tuberculosis is no longer tenable."

Kohler,[c] who reviews Aufrecht's work, justly remarks that it deserves wide recognition, as it supplies important arguments for a thorough revision of the older views about the development of pulmonary tuberculosis.

Fibiger and Jensen[d] conclude from their own investigations and from a critical analysis of the reports from numerous widely separated hospitals that the former doctrine, which taught that primary intestinal tuberculosis is a rare disease, can no longer be held as valid. Among 289 children from 1 to 15 years old who had succumbed to various diseases, 44, or over 15 per cent, were found on autopsy to be affected with primary intestinal tuberculosis. These investigators say that we must, without doubt, return to our former view and

[a] Recherches expérimentales sur la Tuberculose, effectuées à l'Institut Pasteur de Lille, par Calmette et Guérin, P. Vansteenberghe, M. Breton, Grysez, Sonneville et Georges Petit, Paris, 1907. (Reviewed in the monthly publication of the International Antituberculosis Association, Tuberculosis, Vol. VI, No. 5, 1907, pp. 256–259. Also in Zeitschrift für Tuberkulose, Vol. XI, No. 2, 1907, pp. 163–166.)

[b] Berliner Klinische Wochenschrift, vol. 44, No. 27, pp. 829–835, 1907.

[c] Internationales Centralblatt für die Gesamte Tuberkulose-Forschung, Vol. II, No. 1, pp. 9–10, 1907.

[d] Berliner Klinische Wochenschrift, vol. 44, Nos. 4 and 5, pp. 93–96, 134–137, 1907.

regard the ingestion of raw milk as an important cause of primary intestinal tuberculosis during childhood. This view is in perfect harmony with Calmette's experiments, which proved that primary intestinal tuberculosis is of commoner occurrence, with infection that enters the body through the alimentary canal, in youth than in adult life, because tubercle bacilli can pass through the mesenteric glands of adults more readily than through those of children.

B. Fränkel reports that primary tuberculosis of the upper air passages (regions which are exposed to infection carried in food), especially in children, is of common occurrence and is often associated with an enlargement of the cervical and neck glands. Among fifteen cases of tuberculosis affecting the cervical glands (a condition undoubtedly due to infected food) he found five cases that were caused by tubercle bacilli of the bovine type. He says that though persons affected with open tuberculosis are the principal sources of infection, we must not neglect the tuberculous cow.

Weichselbaum, of Vienna, after summing up the different portals through which tubercle bacilli may enter the body, points out that the resulting lesions give us no information relative to the point of entrance. He asserts that the latency of tubercle bacilli and the facts that they may induce a simple hyperplasia or enlargement due to simple cell proliferation, that they may pass through the mucous membranes or lymph glands without causing lesions, that different organs of the body may have different degrees of immunity, etc., must all be taken into consideration in a study regarding the portals of entry, and that deglutition or the act of swallowing must be given a greater significance as a means of infection with tubercle bacilli than it has hithertofore received.[a]

Orth[b] makes the statement that even with localized tuberculosis in the lymph glands and in the lung we can not exclude the intestine as the portal of entry for the tubercle bacillus. At the International Tuberculosis Conference held in Vienna during September, 1907, he said that tubercle bacilli can enter the body from the intestinal canal, which might itself, however, remain completely unaffected, but that from the prophylactic point of view the channel of infection was of only secondary importance, as the object to be aimed at was the destruction of all sources from which infection might take place. As sources of infection he named milk and butter from tuberculous cows and sputum from tuberculous individuals, and bovine tuberculosis he characterized as undoubtedly infectious for human beings.[c]

[a] Report of the International Tuberculosis Conference held at Vienna September, 1907. (Review in Hygienisches Zentralblatt, Vol. IV, No. 10, p. 291, 1908.)

[b] Berliner Klinische Wochenschrift, vol. 44, No. 8, pp. 213–215, 1907.

[c] Editorial in the New York Medical Record, vol. 72, No. 22, p. 905, 1907.

Klebs[a] has convinced himself that tuberculosis is a disease of the lymphatic system and may remain such until the end of life, and that infection occurs through the intestines, most frequently with bacilli contained in cows' milk. He claims to have established this as a fact by experiments made at Berne and published in Virchow's Archives in the early seventies of the last century. He says that he has found no reason to change his views, and calls attention to the conclusive manner in which they have been proved by the unimpeachable experiments of Orth, Von Behring, and Calmette.

Gorter[b] adds his testimony to show that the intestinal mode of infection is not rare, and Bongert[c] showed with rats, as was shown by the Experiment Station of the Bureau of Animal Industry[d] with hogs and cattle, that the injection of pure cultures of tubercle bacilli into portions of the body as remote as possible to the thorax caused pulmonary tuberculosis without intermediate lesions to connect the location of the disease in the lung with the portal at which the infecting bacilli were introduced.

Baumgarten[e] concluded after experimental studies and a review of the literature that for practical prophylactic purposes we must consider not only the inhalation theory and ingestion as modes of infection, but all possible ways in which tubercle bacilli may enter the body.

It is not intended to give a complete summary of all the investigations that have supplied evidence to support the fact that tubercle bacilli can and do penetrate the wall of the digestive tract without affecting it and pass to the lung and there cause lesions. It has been amply shown that the intestinal mode of infection for pulmonary and other forms of tuberculosis, unlike the inhalation of tubercle bacilli directly into the lung tissue, is not merely a theory, but a well-established truth, which has forced its way to recognition in the face of considerable opposition. Hence the frequency with which tuberculosis is a pulmonary disease can not be used as an argument to encourage an undervaluation of the part played by tubercle bacilli in dairy products; on the contrary, the mode of infection with tuberculosis, and the certainty with which tubercle

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[a] Deutsche Medizinische Wochenschrift, vol. 33, No. 15, pp. 577–581, 1907.

[b] Review in Zeitschrift für Tuberkulose, Vol. XI, No. 3, pp. 260–261, 1907. Also review in Internationales Centralblatt für die gesamte Tuberkulose-Forschung, Vol. II, No. 1, pp. 12–13, 1907.

[c] Deutsche Tierärztliche Wochenschrift, vol. 15, Nos. 28–29, pp. 389–393, 405–408, 1907.

[d] Bulletin 93, Bureau of Animal Industry, 1906.

[e] Internationales Centralblatt für die gesamte Tuberkulose-Forschung, Vol. II, No. 1, p. 15, 1907.

bacilli may enter one portion of the body and leave it unaffected and cause disease in other portions, condemn dairy products infected with tubercle bacilli as a serious menace to public health.

The evidence presented relative to the mode of infection, or the portals through which tubercle bacilli enter the bodies of those who contract tuberculosis, in addition to proving that the ingestion of infectious material is as apt as inhalation to cause pulmonary disease, has also shown two other facts—(1) that primary tuberculosis of the organs of digestion and associated structures is commoner than it was formerly believed to be and can no longer be characterized as of rare occurrence, and (2) that tubercle bacilli of the bovine type, judged from the standard of those investigators who make the sharpest distinction between human and bovine types, occur in a large proportion of the cases of human tuberculosis where the lesions of disease are located in the organs of digestion and associated structures.

It is rather curious that bovine tubercle bacilli should be comparatively common in human tuberculous lesions that are located near the portals through which tubercle bacilli are believed to enter the body by those who have discarded the inhalation theory of infection, and that tubercle bacilli of the human type, to the almost total exclusion of those of the bovine type, are associated with tuberculosis of the human lung. An explanation for this, however, is suggested by the morphological instability of tubercle bacilli and the fact that tuberculosis of the lung is usually a chronic disease and may eventually be proven to be altogether a secondary and not a primary manifestation of the infection of the body with tuberculosis.

The relative virulence of tubercle bacilli in moist, opaque substances like milk, cream, butter, and cheese; in dry dust from tuberculous material; in translucent substances like sputum; and in transparent substances like the infectious spray of droplets that escape from the mouths of tuberculous subjects during more or less violent expiratory efforts also seems to emphasize that the tuberculous cow is a very important source of human tuberculosis.

Cornet[a] is probably the strongest advocate of the dust-inhalation hypothesis. According to his views, dried, pulverized tuberculous sputum is the most important factor for the dissemination of tubercle bacilli and the transmission of tuberculosis from person to person, notwithstanding that he himself calls attention to the rapidity with which the bacilli die upon exposure to light and drying, to the difficulty with which a tough, sticky substance like sputum is pulverized, and to the fact that only a small fraction of a mass of sputum can

[a] Cornet, G. Die Tuberkulose, Vienna, 1907, pt. 1, pp. 101–117.

reach a sufficiently fine state of pulverization to float in the air or otherwise attain that consistency which he believes necessary for its direct introduction into the finest branches of the bronchial tubes.

Sunlight is the most potent natural agent for the sterilization of tubercle bacilli; it kills them in less than one hour when they are exposed to its direct rays in translucent layers of infectious pus, and in less than five hours when they are exposed in thick, opaque masses of such pus.[a] Weinzirl[b] asserts that tubercle bacilli, as well as other nonsporulating pathogenic bacteria, are destroyed in from two to ten minutes by direct sunlight, and Koch,[c] Jousett,[d] Flügge,[e] Heymann,[f] Di Donna,[g] Cadéac,[h] and others earlier called attention to the rapidity with which tubercle bacilli are destroyed by desiccation and exposure to light.

If light and drying are the potent factors for the destruction of tubercle bacilli that practical evidence shows them to be, it becomes questionable whether tuberculous sputum, which is so tough that it is difficult to pulverize in a mortar with a pestle after it has been thoroughly dried, ever reaches in nature a state of pulverization that will enable it to float in the air without first wholly losing its infectiousness. Of course there are scores of ways in which moist tuberculous sputum is dangerous, and hence the rapidity with which light destroys tubercle bacilli and the difficulty with which sputum is pulverized must not be taken as facts that justify or excuse careless spitting.

The inhalation of infectious material directly into the lung requires (1) that the infectious material should be suspended in the air, and (2) that it must remain in suspension while the air passes through a long, narrow, tortuous, moist-walled system of channels. We have seen how difficult it is to pulverize the tuberculous material (sputum) from which fine tuberculous dust is supposed to arise, and we have seen how rapidly tubercle bacilli are destroyed when they are exposed to light and drying; hence we may conclude that dust charged with live, virulent tubercle bacilli is by no means plentiful. On the other hand, even if tuberculous dust were abundantly suspended in the air, its penetration into the finer bronchial tubes of the upper portions of the lung, where tuberculous processes most com-

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[a] Circular 127, Bureau of Animal Industry, pp. 17–20.

[b] Journal of Infectious Diseases, May, 1907, Supplement 3, pp. 128 to 153. (Abstract in Experiment Station Record, U. S. Department of Agriculture, Vol. XIX, No. 3, 1907, p. 280.)

[c] Cornet, Die Tuberkulose, Vienna, 1907, p. 41.

[d] Wiener Medizinische Wochenschrift, 1901, No. 28, p. 1366.

[e] Zeitschrift für Hygiene, vol. 38.

[f] Editorial in Journal of American Medical Association, October 12, 1901.

[g] Centralblatt für Bacteriologie und Parisitenkunde, Vol. XLII, No. 7.

[h] Le Bulletin Médical, September 5, 1906.

monly begin, would necessitate a suspension of the laws that govern the relative movements of substances of higher and lower specific gravity actuated by the same force.

When a moving fluid holds solid particles of relatively higher specific gravity in suspension, every change in the direction of the movement will cause the heavier solid particles to move somewhat more tangentially than the lighter fluid. If the movement occurs in a tube, the heavier particles will be thrown with more or less force against the wall of the tube. When the heavier particles are a dry dust and the fluid is a gas, such as air, and the movement occurs in moist-walled channels like the air tubes, the dust will be thrown against and adhere to the moist walls, and the air will be thoroughly purified long before the number of turns or changes of direction have been made that occur in the air passages from the exterior of the body to the finer bronchial tubes. Now, the larger air tubes, on which dust may be deposited, are covered with a ciliated epithelium, or cells, which have fine hairlike processes, that are in constant motion, and the motion is of a kind which tends to move dust, etc., outward and not farther into the lung.

From this it should readily be seen that the inhalation theory to account for the infection of the lung is simple only when we fail to analyze it, and that analysis shows it to be a practically impossible hypothesis.

THE LENGTH OF TIME THAT TUBERCLE BACILLI LIVE AND RETAIN THEIR VIRULENCE IN DAIRY PRODUCTS.

The vitality and virulence of tubercle bacilli in dairy products is very different from their rapid destruction in sputum, and we must bear in mind that they are not on the floor, or in the air, or in other places from which they may or may not gain access to our bodies, but that they are contained within articles of food with which they will certainly be introduced into our bodies.

Broërs,[a] whose work on tuberculous dairy products is based on careful observations, found that tubercle bacilli will live three days in milk even when it has undergone changes that make it unfit for use as food, twelve days in buttermilk, and that they certainly remain virulent in butter three weeks. As milk and buttermilk are rarely used in a raw state after they are more than three days old, it is not necessary to show that the tubercle bacilli which they may contain will remain alive and virulent longer than Broërs has recorded. The length of time the bacilli remain virulent in butter is another matter,

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[a] Broërs, C. W. Untersuchungen über die Dauer der Virulenz von Tuberkelbazillen in Milch, Buttermilch, und Butter, Rotterdam, 1905. Review in Zeitschrift für Tuberkulose, Vol. X, No. 3, p. 260, 1907.

10765—10——10

and regarding it the available data are very contradictory, as is shown by Cornet,[a] who says:

Laser could find no live tubercle bacilli in butter after twelve days; Heim records that all tubercle bacilli eventually die in butter and that their maximum life in it is thirty days; Gasperini found a reduction of virulence after thirty days, though the bacilli were still alive after one hundred and twenty days, and Dawson did not observe a reduction of virulence until after three months and claims to have produced tuberculosis in a guinea pig by inoculating it with butter eight months old.

As the two extremes, twelve days and eight months, were too far apart to be satisfactory, an investigation relative to this matter was undertaken at the Experiment Station of the Bureau of Animal Industry.[b] Butter was made from the milk of a cow affected with udder tuberculosis and was tested from time to time by making guinea-pig inoculations with it. The butter was salted at the rate of 1 ounce of salt to the pound of butter. The guinea-pig inoculations showed that the tubercle bacilli underwent no attenuation in forty-nine days, that they were still highly virulent after ninety-nine days or more than three months, and that they were still alive after one hundred and thirty-three days. Since these tests were published it has been found that the bacilli were still alive after one hundred and sixty days, which indicates that Dawson's period of eight months is not an exaggeration.

As the investigations of the Experiment Station regarding the long-retained virulence of tubercle bacilli in butter called out a popular criticism to the effect that the inoculation of guinea pigs was not a sufficient test to show that such bacilli are dangerous when they are ingested, the following experiment was made:

Four hogs weighing 125 pounds each were tested with tuberculin to make sure that they were free from tuberculosis and were then placed in four separate disinfected pens. Each hog was fed 1 ounce of butter daily in addition to its other feed; the butter was of the kind used for the guinea-pig inoculation tests; the feeding was continued thirty days. This butter consisted of several different lots, the youngest of which was 90 days or 3 months old when it was fed to the hogs. The amount of butter received daily by each hog was less than the average person of the same weight eats, and the total amount received by each hog was less than 2 pounds. Several months after the feeding of butter was discontinued the hogs were killed and examined post-mortem, and three of the four were found to have contracted tuberculosis.

More direct evidence to prove that tuberculosis is contracted from infected food, and more direct evidence to prove that tubercle bacilli

[a] Cornet, G. Die Tuberkulose, Vienna, 1907, pt. 1, p. 124.

[b] Circular 127, Bureau of Animal Industry.

remain alive and virulent a quarter of a year in ordinary butter, would be difficult to obtain.

In oleomargarin tubercle bacilli may also remain alive long periods of time, probably as long as in butter, which it closely resembles in general character. In cheese the germs are especially dangerous when they occur in fresh products like cottage cheese, but that even those cheeses which require some time to ripen are not wholly safe is shown by the fact that Prof. F. C. Harrison proved that tubercle bacilli may remain alive in Cheddar cheese, a standard American variety, one hundred and four days.[a]

We may conclude, as far as it is possible to test the vitality and virulence of tubercle bacilli from different sources and in different environments, that those from cattle are as a rule the most virulent, and that it seems clear that dairy products generally, and butter especially, supply an ideal medium for the preservation of both the life and the virulence of tubercle bacilli.

THE PROPORTION OF TUBERCULOUS COWS AMONG THOSE IN USE FOR DAIRY PURPOSES.

General statistics from which we can determine the percentage of dairy cows affected with tuberculosis are not obtainable. About 17 per cent of the cows supplying milk to the District of Columbia reacted to the tuberculin test, and in the State of New York the figure among those tested rises to about 30 per cent. It does not absolutely follow from this that the cattle of New York State are more commonly tuberculous than those of the District of Columbia, because in both places the number tested is only a small portion of the total number in use, and the percentages of tuberculosis obtained may have been influenced largely by the motive that prompted the application of the test. When tests are made at the request of those who own dairy herds it may be assumed that the owners of exceptionally good herds will be in the majority, and the percentage of tuberculosis discovered will be low. If, on the other hand, the tests are largely forced for the protection of public health because tuberculosis is suspected among the tested animals, the percentage of tuberculosis found will rise to a high figure.

The writer has personally tested a large number of dairy herds in widely separated localities, and in all his tests did not have the good fortune to find a single herd entirely free from tuberculosis. Most of the herds, however, were tested at the request of owners who had some reason to suspect tuberculosis among their cattle, and hence this discouraging experience can not be used as a reason for assuming that but few perfectly healthy dairy herds exist.

[a] Nineteenth Annual Report, Bureau of Animal Industry, 1902, p. 228.

From the figures and estimates that are available it seems fair to conclude that not less than 20 per cent of our dairy cows are tuberculous, and that tuberculosis occurs to some extent in about 30 per cent of our dairy herds. These are believed to be conservative figures, but they must be taken as having simply the value of an estimate. In some European countries, where better statistics are available than in the United States, it is safe to conclude that not less than 40 per cent of all dairy cows are tuberculous, and this high percentage will be reached among our dairy cattle before long, unless vigorous means are used to prevent the further spread of tuberculosis among them.

THE FREQUENCY WITH WHICH DAIRY PRODUCTS CONTAIN TUBERCLE BACILLI.

The truest test of the measure in which the public is exposed to tubercle bacilli from bovine sources is the frequency with which tubercle bacilli occur in dairy products. Without reviewing earlier investigations or those made in foreign countries, four comparatively recent investigations made in America show how common is the occurrence of virulent tubercle bacilli in milk. The largest of the four investigations showed that 15, or 6.7 per cent, of 223 samples of milk contained tubercle bacilli. The milk was obtained from 102 dairies, among which 11, or 10.7 per cent, were distributing infected milk.[a] The second investigation showed that 2, or 2.7 per cent, of 73 samples of milk contained tubercle bacilli.[b] The third investigation showed that 2, or 5.5 per cent, of 36 samples of milk contained tubercle bacilli. The milk was obtained from 26 dairies, among which 2, or 7.7 per cent, were distributing infected milk.[c] The fourth investigation showed that 17, or 16 per cent, of 107 samples of milk contained tubercle bacilli, and that among 8 samples of commercially pasteurized milk 1 was found that contained live tubercle bacilli.[d]

The four investigations taken together show that among 439 samples of milk, 36, or 8.2 per cent, were infected with live, virulent tubercle bacilli.

The fact that 1 among 8 commercially pasteurized samples of milk contained living tubercle bacilli is conclusive proof that some of the so-called "pasteurization," commercially practiced, is worse than useless and has the evil tendency to quiet the mind regarding grave dangers that it does not correct.

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[a] J. F. Anderson, United States Public Health and Marine-Hospital Service, Hygienic Laboratory, Bulletin No. 41, pp. 163–192.

[b] J. R. Mohler, loc. cit., pp. 493–495.

[c] Unpublished work of the Experiment Station of the Bureau of Animal Industry.

[d] Dr. Alfred Hess, of New York. Paper presented at the International Congress on Tuberculosis, Washington, D. C., 1908.

It is a serious charge against the milk commonly sold by dairies to say that fully 1 sample among every 12 contains living, virulent tubercle bacilli, and yet this is the most favorable conclusion we can draw from four of the most recent and thoroughly reliable investigations with which the writer is acquainted.

A further analysis of the two among the four milk investigations that give the number of dairies from which milk was tested proves that the conditions are worse than their superficial appearance indicates. These two investigations show that 17, or 6.5 per cent, of 259 samples of milk obtained from 128 dairies were infected, and that the infected milk was sold by 13, or 10 per cent, of the dairies. The two investigations also show that the total number of samples of milk obtained from the 13 infected dairies is 31, of which 17 were infected and 14 were free from infection. Hence, the difference between the percentage of infected milk samples and the percentage of infected dairies can not be explained on the assumption that it is due to the more frequent duplication of tests with milk from the noninfected than from the infected dairies. It is shown on the face of the evidence that the difference between the two percentages is due to the fact that infected dairies distribute infected milk intermittently and not continuously.

The intermittent distribution of infected milk by infected dairies is interesting not only because it may be related to the intermittent expulsion of tubercle bacilli by cattle with their feces, but also because it justifies the conclusion from the milk tests under consideration that a larger proportion of dairies than even 10 per cent must be classed as infected.

To obtain further information regarding the intermittent distribution of tuberculous milk by infected dairies,[a] milk was bought on thirty different days from a dairy from which several months previously a sample of milk had been obtained that was found to be infected with virulent tubercle bacilli, and samples were injected into guinea pigs. Among the 30 samples the second, third, and eighth were found to contain tubercle bacilli, and the remaining 27 were not infected. If we add to the 30 later samples the sample of milk which first showed the infected character of the dairy, we have 31 from one source, among which 4, or about 13 per cent, were found to contain tubercle bacilli. It does not require much reasoning to conclude from this evidence that the chances for discovering an infected dairy by testing one sample of milk from it may be equal to only 13 per cent, and that the chances that the one test will not reveal the infected character of a dairy may be nearly eight times as great as the chances that it will.

[a] Unpublished work of the Experiment Station of the Bureau of Animal Industry.

The intermittent distribution of infected milk by dairies is well illustrated through the investigation of the milk supply of the city of Leipzig, Germany, made by Professor Eber, of the University of Leipzig.[a] The milk for this investigation was obtained from 70 dealers, from each of whom one sample of milk was bought for each of three series of tests. The first series of tests revealed that the milk of 6, the second that the milk of 9, and the third that the milk of 7 dealers contained live, virulent tubercle bacilli. The first series of tests was made during February and March, the second during April, May, and June, and the third during November, December, and January. The total number of samples of milk tested was 210, and among them 22, or 10.47 per cent, were found to be infected with tubercle bacilli. The samples of infected milk were obtained from nineteen dealers, one of whom sold 3, one 2, and seventeen 1 each of the infected samples; hence, among the total 70 dealers, 19, or 27.1 per cent, were more or less intermittently selling infected milk. It is quite clear from this that, though only a little more than one-tenth of the milk contained tubercle bacilli in sufficient numbers for detection, something more than one-quarter of the dealers were actually proven to be selling unsafe milk.

Had Professor Eber continued to make series of tests from time to time with the milk sold by the 70 Leipzig dealers, it is quite probable that he would have found no great variation in the percentage of infected milk, but that the percentage of dealers selling infected milk would gradually have climbed higher until a very ominous maximum had been reached.

I do not wish to create an exaggerated idea of the proportion of dairies that intermittently distribute tubercle bacilli in milk, because the facts are so grave that, without exaggeration, they are almost beyond belief. It is well, however, to know the truth, and, through knowing it, to be convinced that the milk of no dairy can be accepted as permanently free from tubercle bacilli unless it is obtained in a clean, wholesome environment from cows shown by the application of the tuberculin test to be free from tuberculosis.

We must bear in mind here that infection with tuberculosis does not always occur even after the germs of the disease have been introduced into the body with food or otherwise. Various incidents, it seems, must fall together with the presence of tubercle bacilli in the body before the disease develops. If this were not the case, the frequency with which dairy products contain live tubercle bacilli and the wide distribution that the bacilli have in such products would alone be sufficient to destroy the human race. As no one can say when the requisite incidents to give the tubercle bacillus the best

[a] Translation published July, 1908, as a pamphlet in the interest of the pure-milk movement, by J. Willman, Shelton, Conn.

chance to cause disease are present, the introduction of tubercle bacilli into the body with milk, cream, or butter every second, third, or fourth day, or only once weekly or monthly, should be regarded as a danger against which we should strive to protect public health.

The available data regarding the frequency with which tubercle bacilli occur in butter and other dairy products than milk are very meager for the United States, but when we know that tubercle bacilli in milk are transferred to the cream, butter, cheese, etc., made from it, we can readily infer how commonly these products are infected. Relative to the infection of cream and butter the following paragraph from a report of the Secretary of Agriculture is very significant:[a]

> The examination of sediment taken from cream separators of public creameries throughout the country has demonstrated the presence of tubercle bacilli in about one-fourth of the samples.

In a recent publication of the Bureau of Animal Industry[b] it was pointed out that both the tendency of tubercle bacilli to rise with cream and a comparison of European statistics relative to the frequency with which tubercle bacilli have been detected, respectively, in milk and butter indicate that when the bacilli are present in milk they will no doubt be present in greater concentration in cream and butter.

We can protect ourselves against the tubercle bacilli that are distributed in milk by practicing home pasteurization, but with butter this is not possible, and it is therefore desirable that the milk or cream used in the manufacture of butter should either be obtained from cows certainly free from tuberculosis or be pasteurized before it is used.

SUMMARY.

We have seen that tuberculosis is the commonest disease of both persons and dairy cows, and that persons and dairy cows are its commonest victims; we know that dairy products are indispensable and that they are more commonly eaten in a raw state than other products from animals; we have seen that tuberculosis is an insidious, chronic disease, and that tuberculous cows often expel tubercle bacilli long before they show signs of their diseased condition; we have seen that milk is almost invariably contaminated with the material in which tuberculous cows most commonly expel tubercle bacilli from their bodies; we have seen that milk is so often infected with virulent tubercle bacilli that, unless we know it to be derived from cows that are certainly free from tuberculosis, it is not safe to use it in a raw

[a] Annual Report of the Secretary of Agriculture, Washington, D. C., 1907, p. 30.

[b] Circular 127, Bureau of Animal Industry, 1908, pp. 4 and 5.

state; we have seen that tubercle bacilli in milk are transferred to the cream, butter, and cheese made from it, and may occur in these products in greater concentration than in the milk from which they are derived; we have seen that an excellent medium for the preservation of the life and virulence of tubercle bacilli is found in butter by reason of its moist, bland, opaque character; we have been told that the medical profession is well-nigh unanimous in the view that tubercle bacilli from the bovine source in dairy products are a serious menace to public health; and we have seen that, in our fight for the suppression and eventual eradication of tuberculosis, we must seek to make harmless all the sources from which tubercle bacilli are expelled. Add to this that the available evidence regarding different types of tubercle bacilli shows that bovine types have been found in human lesions and human types in bovine lesions; that transition forms connect bovine types directly with human types; that the most variable feature about a tubercle bacillus is the character that is used to classify it as a special type; that tubercle bacilli of human types have been converted into bovine types and those of bovine types into human types; and that tubercle bacilli of the so-called bovine type are, as a general rule, more virulent than those of the human type for all animals, including man-like apes; and the conclusion is almost forced upon us that the tuberculous dairy cow is, to say the very least, one of the most important sources of tubercle bacilli with which we have to deal.

The commoner occurrence of tuberculosis in the lung than in other parts of the body should not encourage us to undervalue tubercle bacilli concealed in articles of food, as it has been shown that infection may penetrate to the lung as easily by way of the intestine as directly through the trachea and bronchi; in fact, a critical consideration of the two modes of infection—inhalation and ingestion—shows that the latter is in better harmony with known facts than the former.

The normal channel through which solid material from without enters the body is the digestive canal. It has been shown by Nicolas and Descos, by Ravenel, by Schloszmann and Engle, by Calmette and his associates, and by other bacteriologists and pathologists too numerous to mention, that tubercle bacilli may penetrate rapidly through the healthy walls of the intestines and reach the great thoracic lymph duct. The thoracic duct empties its contents into one of the large veins that communicate with the heart; mixed with the blood in this vein the material from the duct enters the heart and is pumped directly to the lung, where it is filtered through the lung capillaries, which are the finest and most complex capillaries of the body. If we recall that the careful anatomical examinations made by Aufrecht and by Calmette and his associates proved that the

tuberculous processes in the lungs have their beginning in the finer lung capillaries and not in the finer air tubes, we are in a position to conclude that infected food, much more than infected air, is to be dreaded as a cause of tuberculosis.

Tuberculosis among dairy cows is so common and widespread that we can not hope to clean all dairy herds of the disease for some time to come; hence it is necessary, for the protection of health, to avail ourselves of the one expedient which is immediately at hand, and that is pasteurization. And pasteurization should not be restricted to milk, but all milk, cream, etc., used in the manufacture of butter, cheese, and other dairy products should be pasteurized unless it is obtained from healthy, nontuberculous cows that are stabled under hygienic conditions in an environment wholly free from tuberculous infection.

The elimination of tuberculosis from the dairy herd is urgently recommended, not only because the protection of public health requires it, but also because tuberculosis among cattle is a serious cause of pecuniary loss, so serious indeed that from the strictly economic point of view it must be regarded as the most important problem that those interested in animal husbandry can undertake to solve.

THE CAUSATION AND CHARACTER OF ANIMAL TUBERCULOSIS, AND FEDERAL MEASURES FOR ITS REPRESSION.[a]

By John R. Mohler, V. M. D.,
Chief of the Pathological Division.

There is probably no disease of animal or man which is at present receiving more consideration from the practitioner, the sanitarian, and the economist than tuberculosis. Furthermore, it is one of the most prevalent diseases, and is responsible for more deaths among people and greater financial loss to stock owners than any other affection. Because of this widespread interest in tuberculosis and on account of its ravages, which extend to all the mammalia as well as birds and reptiles, it has seemed advisable to present a brief discussion of the character, causation, and prevalence of tuberculosis.

THE VARIOUS METHODS OF TUBERCULOUS INFECTION.

In the study of tuberculosis the names of two scientists stand out prominently. The first is Villemin, who in 1865 demonstrated by animal experiments that tuberculosis was an infectious disease; the second is Koch, who in 1882 isolated the causative factor of the disease, *Bacillus tuberculosis*. This bacillus is the only cause of tuberculosis, and is always derived from a preexisting case of the disease, whether in man or in animal. Its presence is readily demonstrated in the lesions of the affected parts as well as in certain discharges and secretions. Its peculiar ability to hold tenaciously the stain after once taking up the color despite the action of acids, and the difficulty in obtaining a growth of the organism on culture media, are facts familiar to bacteriologists.

The chief method by which the tubercle bacillus enters and obtains lodgment in the animal body is not so well known, however, and to-day there are two principal theories on this subject, both of which have many adherents among leading scientists. One opinion which has been adhered to for years is that the principal mode of infection in tuberculosis is by the inhalation of bacilli-laden air, thus permitting the almost direct lodgment of tubercle bacilli within the lungs, with subsequent development of pulmonary lesions, which are generally the most pronounced alterations present. The opposite

[a] Presented at the annual convention of the American Veterinary Medical Association, Philadelphia, Pa., September 10, 1908, as a part of the report of the committee on diseases.

view, while admitting that pulmonary tuberculosis is by far the most common form of the disease, holds that the lungs become diseased indirectly as a result of the tubercle bacilli entering the system by the mouth (ingestion), after which they are swallowed, taken up by the intestinal lacteals without any injury to the intestinal mucous membrane, pass into the thoracic duct, thence into the venous circulation, and finally are filtered out of the blood by the lungs. That this latter opinion is correct in a great number of instances is supported by numerous careful experiments, and this is probably the chief method of infection, especially in animal tuberculosis.

That there are other channels of entrance for tubercle bacilli in addition to the digestive and respiratory tracts is evident by a study of such localized lesions as the tuberculous genitals of a bull, or a local tuberculous arthritis of the hock joint, indicating, respectively, infection by way of the genital tract and by direct inoculation through the skin. Hereditary transmission, or congenital tuberculosis in the offspring, is evidently more frequent in cattle than in man, but nevertheless it must be considered as a rare form of infection. In the few cases of fetal tuberculosis that have come under the writer's observation, lesions of the maternal placenta were always in evidence. However, infection could occur by means of the semen, although such cases are believed to be exceedingly rare.

Hereditary transmission is therefore not to be regarded as an important cause of tuberculosis; the cause is rather to be found in some form of exposure to infection after birth has taken place. Predisposing causes which arise from insanitary conditions, lowered vitality, exposure, forced development, etc., only are responsible for giving the true cause (*Bacillus tuberculosis*) an opportunity for lodgment and development, or better facilities for propagation in case the lesions are already present.

COMPARATIVE STUDY OF TUBERCLE BACILLI.

The greatest interest attaches to the relationship of tubercle bacilli as found in their several hosts. This relationship between the tubercle bacilli recovered from the various species of mammals, birds, fishes, and reptiles is certainly very intimate. It may be that the slight differences which may now be demonstrated between the different types of tubercle bacilli have been of slow development, and due to their environment, to differences in the temperatures at which they have been forced to live, and to differences in the amount and quality of the nutrition with which they have been supplied. Whatever the variations between the types, they are not great enough to prevent the successful interchange of tubercle bacilli by means of inoculations between representative hosts of the several types.

The slow but gradual transformation of certain growths of tubercle bacilli should not be considered such an impossibility. Other forms of bacterial life yield to the peculiar influences of their environment, and why should not the tubercle bacillus be equally susceptible to change? In fact, experiments have been conducted which show conclusively that some tubercle bacilli may be transformed in form, pathogenicity, and cultural characteristics as well. More than this, cultures which seem incapable of attacking certain species of test animals with the degree of severity which one would expect, in view of their average virulence for animals of other species, may be brought to change their peculiar affinities until they will prove virulent for a species of animal formerly resistant.

An interesting experiment was recently made in the Pathological Division by cultivating a bovine bacillus upon sterilized human blood. After three months' growth upon this medium the bacilli became transformed into long, beaded organisms which grew more readily than upon dog or bovine serum, and closely simulated the human type of bacilli. They had evidently assumed a more saprophytic character and were capable of more rapid accommodation to cultural exigencies as a result of some constituent of the human blood.

RELATION TO PUBLIC HEALTH.

The latest researches into the question of intertransmissibility of tubercle bacilli from various sources have shown that Koch's doctrine, enunciated in 1901, is not warranted. Variations do occur among tubercle bacilli as among other forms of bacteria, but they are not constant. It is well known that Koch demanded as a criterion of the animal origin of tuberculosis observed in man the proof that cattle, when injected with human tubercle bacilli, will contract tuberculosis. Decisive proofs of such infection have now been obtained not only by the German Commission on Tuberculosis, which was appointed at Koch's request, but also by the Royal English Commission, besides numerous French, Dutch, English, Scandinavian, Austrian, and American investigators. In fact, there have been so many instances on record of bovine tubercle bacilli having been recovered from human tissues, and of instances of butchers and others receiving accidental infections of the skin directly from bovine lesions, that it appears entirely proven that man is susceptible to tuberculosis caused by bovine bacilli. This view was crystallized in a resolution adopted by the International Congress on Tuberculosis recently held in Washington, D. C., as follows:

Resolved, That preventive measures be continued against bovine tuberculosis, and that the possibility of the propagation of this infection to man be recognized.

While the presence of bovine tubercle bacilli in human beings is seen to be not infrequent, no definite conclusions can be drawn at present as to the extent of such infection, owing to the lack of data on the subject. But the fact that tubercle bacilli of one species may be transmitted to an animal of a different species or to man makes it apparent that any preventive methods for controlling tuberculosis, to be successful, must take into consideration all species of animals which are susceptible to tuberculosis.

DANGER FROM MILK AND MEAT.

The most frequent sources of danger from bovines to man, and the only ones to be considered, are the milk and the meat of tuberculous animals. The fact that most of the cases of bovine tuberculosis occurring in man are cases of infantile tuberculosis points with grave suspicion to the milk rather than to the meat supply. That milk coming from a tuberculous udder is capable of transmitting the infectious principle requires no further argument. It has been equally well established that in advanced generalized tuberculosis the udder may excrete tubercle bacilli without showing any indication of being affected. Other experiments have demonstrated that tubercle bacilli may be eliminated by cows affected with tuberculosis to a degree that can only be detected by the tuberculin test, so that in a herd of cows in the various stages of tuberculosis it is to be expected that some of them will excrete tuberculous milk, which, when mixed with other cows' milk, makes the entire product dangerous.

The ease with which tubercle bacilli may be eliminated by the udder was strikingly illustrated by an experiment conducted by the British Royal Commission, in which a cow, injected with human tubercle bacilli under the skin of the shoulder, began excreting tubercle bacilli from the mammary gland seven days later, and continued to do so until its death from generalized tuberculosis thirty days after inoculation. Furthermore, Titze, of the Kaiserliche Gesundheitsamte, proved that human tubercle bacilli when injected into the jugular vein of milch cows may be excreted with the milk. In his first experiment the excretion of the bacilli began in the third week and continued until the one hundred and forty-fourth day. In a subsequent test tubercle bacilli began to be excreted after twenty-four hours, but no tubercle bacilli could be found after ninety-nine days. In both these cows only the milk from the left hind quarter proved to be infectious. It has been shown by Gaffky and Eber in Germany, and Schroeder in this country, that even when the tubercle bacilli are not excreted by the udder the dust and manure of the stable where the diseased animals are kept are in many cases contaminated with tubercle bacilli. This contaminated material may readily

pollute the milk during the process of milking, even though the milk comes from a healthy cow. The importance of this method of infecting milk can not be too greatly emphasized when it is known that cattle with slight alterations in the lungs frequently raise tuberculous mucus into the pharynx while coughing, and by swallowing this material contaminate the feces.

Having ascertained the grave and positive danger to man of tuberculous milk it becomes necessary to determine if tuberculous meat contains the infectious agent, and if it can reproduce the disease in animals fed or injected with it. Through the extensive experiments of numerous investigators much evidence has been accumulated, to the effect that meat of animals affected with generalized tuberculosis may contain virulent tubercle bacilli. The experiments of Kastener, Hoefnagle, and Westenhoeffer are especially of interest, as well as of great importance, because they took into consideration the extent, character, and condition of the tuberculous lesions. In one series of tests Kastener fed to experiment animals meat from cattle which were affected with localized tuberculosis, the carcasses of which had been passed for food. In this series he could not obtain a single positive result, while with meat of condemned tuberculous carcasses his results in every instance were positive. It is therefore apparent that the condemnation of tuberculous meat is carried out not only from an esthetic standpoint, but because there is sufficient proof at hand which points to the danger that might arise from the ingestion of such meats. For this reason it appears desirable to have all products coming from animals affected with tuberculosis, as well as the slaughter and disposal of such animals, placed under the supervision of an experienced inspector. Since the flesh of all tuberculous animals is not equally dangerous, there must be rational discrimination between the meat of slightly or locally diseased carcasses and that of the more extensively diseased carcasses, the former having experimentally given negative results, the latter proving to be infectious.

PREVALENCE OF TUBERCULOSIS.

It is a well-known fact that tuberculosis is the most serious disease with which the American farmer has to contend. It is widely spread among cattle and is yearly appearing with increased frequency among our hogs. In addition, centers of poultry infection are recently being recorded in various parts of the country, which fact is naturally leading to great uneasiness among breeders of purebred fowls. There are other losers besides the farmer and poultry man, as the owners and keepers of menageries and zoological parks are forced to pay heavy animal toll to the ravages of tuberculosis. Monkeys and deer when kept in captivity rapidly succumb to tuberculous infection, while animals of the raccoon and beaver families, and occa-

sionally some member of the bird tribes, will give evidence of their susceptibility to the disease.

Infection of cattle and hogs is most frequently seen in districts in which dairy interests are prominent, but the arid southwestern plains and even the Pacific mountain regions are not totally free. The losses from tuberculosis to the farmers of this country can hardly be appreciated or calculated. There were condemned during the fiscal year 1908 by the inspectors of the Bureau of Animal Industry 24,371 whole carcasses of beef and 77,584 whole carcasses of hogs, as well as a much greater number of parts of carcasses. State dairy inspectors condemn numerous dairy cows for tuberculosis, and large numbers are slaughtered at small private slaughterhouses where no record of numbers or values is kept. Breeders of purebred cattle are also forced to bear heavy burdens through losses of valuable breeding animals and through the disturbance of their trade with would-be purchasers. In this connection it may be stated that the breeder of purebred stock who is in position to warrant his stock as free from tuberculosis will find such guaranty to be a valuable recommendation for his herd, and satisfactory sales will no doubt result, which could not be made from a herd in which tuberculosis was suspected.

The recent awakening of interest in the matter of obtaining pure milk supplies for our various cities and towns, 41 of which have tuberculin-test ordinances, has led to the application of this test to many dairy herds. The extent of tuberculosis detected in these cases by the use of Bureau tuberculin has varied in the several States from 2.79 to 19.69 per cent.

It has been estimated in the Bureau of Animal Industry that the annual sum that may be charged to loss and depreciation through tuberculosis in cattle and hogs is in the neighborhood of $23,000,000.

The increasing frequency with which tuberculosis is being discovered among flocks of fowls and pigeons calls attention to another source of considerable loss through this disease. These centers of avian infection are widely separated, having been found on the Pacific coast, along the Hudson River, and at intermediate points. In all of the flocks attacked and examined it has been noted that the spread of the disease among the birds has been very rapid, and so virulent has the infection proved that only a few of the individuals in a flock escape after the infection has become established. The disease is spread readily from bird to bird by way of the digestive tract; and from the well-known habit of fowls picking their food out of dirt, and even from manure piles, it is evident that the infection will be quickly taken up by the healthy members of the flock.

FEDERAL WORK IN SUPPRESSING TUBERCULOSIS.

Inasmuch as there are already thirteen States enforcing laws regarding the entrance of tuberculous cattle, other States will naturally follow sooner or later in order to avoid becoming the dumping ground of tuberculous cattle not permitted entry into the first-mentioned States.[a] While the laws in these States differ much in detail, the general plan is to require that cattle introduced for breeding or dairy purposes be tested with tuberculin and their healthfulness certified by the authorities of the State from which they originate, or, failing in this, by the authorities of the State in which they are destined to remain. With a large number of States demanding the tuberculin test for all breeding and dairying cattle entering therein, the establishment of tuberculin testing stations at appropriately situated stock yards for the inspection of cattle about to be shipped interstate will no doubt become a necessity, both from an economic as well as a sanitary standpoint, and such work will naturally come under the supervision of the Federal Government.

The Bureau of Animal Industry is already doing much toward reducing and preventing tuberculosis in the United States, which action is indicative of what may be expected in the future. About eight years ago the Bureau endeavored to assist the individual States in guarding against infection from foreign countries by requiring cattle imported from such countries to be accompanied by a certificate of healthfulness shown by a tuberculin test made by an official veterinarian, while those coming through the quarantine stations were tested by the superintendents during the period of detention.

Two objectionable features led to a change in these methods. The first was the frequently unsatisfactory certificates of tests made in the country of origin, and, second, the loss which was inevitable in case any of the imported cattle reacted after reaching the United States. To overcome these objections, the Bureau in 1900 detailed one inspector to Great Britain and another along the Canadian border for the purpose of testing all cattle intended for export to this country, in order that only healthy cattle would be brought in. This practice still continues in Great Britain, but reciprocity has been established with the Canadian authorities by which we accept tuberculin-test certificates from any of their official veterinarians. The benefit derived from this regulation is indicated from the fact that the inspector in Great Britain has rejected on account of tuberculosis as high as 33 per cent of all the cattle tested by him in one year for shipment to this country, and a large number of badly diseased herds have been located from which no importations are permitted.

[a] Since this was penned—in fact since January 1, 1909—nineteen additional States have enacted laws regarding the tuberculin testing of incoming cattle, making thirty-two States having such laws.

Similarly, the Bureau has had occasion to test with tuberculin a large number of purebred cattle intended for shipment into Canada, Argentina, Uruguay, and other countries requiring such certificates of health; and the breeders of full-blooded cattle are also being encouraged and assisted by the Bureau in cleaning their herds. By such testing, new centers of infection are located, advice is given to the breeders as to the best methods for controlling the disease, and the State authorities are notified for such action as they may deem advisable.

Furthermore, the meat-inspection service during the past two years has been used as an adjunct in determining the extent and prevalence of tuberculosis in individual States. This has been accomplished by obtaining all available information concerning each lot of tuberculous animals slaughtered, and in case these animals can be traced back to the farm whence they came, the breeder or feeder, as the case may be, is notified concerning the post-mortem findings on his animals, and likewise the State veterinarian or sanitary officer is informed, in order that the testing of the remainder of the herd and the disinfection of the premises may be properly carried out.

In order to prevent as far as possible the interstate traffic which has evidently been going on in cattle that had reacted to the tuberculin test, the Secretary of Agriculture in 1907 issued a notice classifying tuberculosis as one of the contagious diseases to be controlled under the law, and calling attention to the fact that it was an offense against the law to drive or transport cattle that were known to be tuberculous across State lines. While the fact that such action is illegal may not cause it to be entirely stopped, law-abiding citizens will conform to the law, and with the earnest prosecution of all cases of violation detected this practice will be greatly reduced. Notice has been furnished railroad and steamship companies, cattle raisers, and stock papers that it is a violation of the Federal statutes to ship animals affected with tuberculosis from one State to another, and the only hardship it occasions is with stock owners in one State who are unable to send their cattle to a packinghouse center located in close proximity in an adjoining State. However, the benefits of such an order are so superior that they greatly overcome the few disadvantages.

Congress has also granted power to the Department of Agriculture to examine and report upon the results obtained from the use of various kinds of tuberculin sold in this country. This power of keeping the public informed upon the value of such an important biological product as tuberculin came none too soon, for worthless tuberculin has been found on the market, and there can be no question that many inconsistent results—results which were embarrassing to the testers and caused dissatisfaction among the stockmen—

from the use of different tuberculins can be explained by the inertness of certain of these products.

The testing of a few dairy herds near the District of Columbia showed the widespread distribution of tuberculosis and the serious extent to which it prevailed among the cattle in that vicinity. This knowledge, coupled with the agitation of the citizens of Washington for a pure milk supply, led the Bureau to volunteer to test all herds supplying Washington with milk, provided the owners would agree to disinfect the premises afterwards and endeavor so far as possible to keep their herds free of this disease. The herds belonging to Government institutions and other public organizations in various parts of the country have likewise been tested by the Bureau, not only as a repressive measure, but also as an object lesson for the owners of other dairy herds in their vicinity.

Since 1893 the Bureau has been constantly assisting some of the States in controlling tuberculosis by preparing and distributing tuberculin to their State and municipal health authorities and sanitary officers, and during the last few years the demand has been greatly increased, 215,000 doses having been sent out in the past year.

In the appropriation act for the Department of Agriculture for the fiscal year 1909 Congress authorized a study of the extent and prevalence of tuberculosis in the United States. In order to determine these facts both quickly and accurately the work will necessarily be undertaken in those States where cooperation can be obtained, not only from the standpoint of organization and funds, but also with reference to having proper laws regarding the entry of tuberculous cattle; in other words, it will be the object to help those States that are endeavoring to help themselves. Already several veterinary inspectors have been stationed at important shipping points for the purpose of accommodating shippers who desire to have cattle tested which are destined for States requiring the tuberculin-test certificates, and while this work at present is entirely voluntary, the establishment of a large number of such points would probably follow if more States had compulsory tuberculin-test laws.

It will therefore be seen that a constantly increasing activity relative to the suppression of tuberculosis is being manifested by the Bureau of Animal Industry, and I believe the day is not far distant when all breeding and dairy cattle crossing State lines will be required to show a tuberculin-test bill of health. A great impulse will be given this subject in consequence of the educational propaganda resulting from the International Congress on Tuberculosis held in Washington. If the States themselves would all enact such laws, the enforcement of an order for the testing of the above classes of cattle entering interstate commerce, and the appointment of veterinary tuberculin testers by the Government to all the principal

shipping centers, would be more likely to follow. In this event it probably would not be long before the country would be divided into districts for the eradication of tuberculosis, as it is at present in the South for the repression of the fever tick, and in the West for the extermination of the cattle and sheep scab mites.

The effort to control tuberculosis is a most reasonable and proper one, and if conservatively directed should receive the support of every friend of the cattle industry. Not only is tuberculosis a disease to be dreaded because of the value of the cattle which it injures or destroys, but its existence is believed by the best sanitary authorities to be a serious menace to the health of the consumers of meat and dairy products. The individual States therefore have good reason for desiring to stop the importation from other States of tuberculous animals and for adopting measures intended to lessen or control the disease within their own borders. The herds of the United States are far less seriously affected with tuberculosis than are those of European countries, and the proportion of animals affected in Europe indicates both the danger which threatens our herds if the disease is allowed to progress here, and the importance of thorough measures to prevent it from becoming as prevalent in this country as it is in that part of the world.

THE TRANSMISSION OF AVIAN TUBERCULOSIS TO MAMMALS.

By JOHN R. MOHLER, V. M. D., *Chief of the Pathological Division,*
AND
HENRY J. WASHBURN, D. V. S., *Senior Pathologist, Pathological Division.*

INTRODUCTORY REMARKS.

The ravages of tuberculosis in the avian family are so patent that the gravity and increasing prevalence of this affection must not be ignored. The first outbreak of fowl tuberculosis in the United States was reported by Pernot in Oregon during 1900. The disease has since been located in California by Moore and Ward in 1903, in Canada by Higgins in 1905, in New York by Burnett in 1907, and in Michigan by the Bureau of Animal Industry in 1907. Four other outbreaks of avian tuberculosis have been studied by the Pathological Division since 1907, which indicates the probability of the disease being much more extensive in its depredations than has hitherto been realized. Other writers have reported tuberculosis among poultry, but the failure to make bacteriological demonstrations makes these reports useless as scientific evidence.

In the cases investigated by the Pathological Division both dead and live birds were received, showing in some instances incipient and in others generalized tuberculosis, as attested by microscopic demonstration of the tubercle bacillus, and the feeding experiments carried on afterwards resulted successfully in from three to five months. The importance of continued investigation in this direction is shown by the fact that numerous vague diagnoses under the title of liver disease, spotted liver, "going light," rheumatism, etc., are common among poultry raisers, some of which in the above-mentioned demonstrations have been proved to be tuberculosis, thus suggesting that avian tuberculosis is rapidly becoming disseminated. The finding by all investigators of multitudes of tubercle bacilli in the feces suggests the ease with which the disease may be spread throughout the flock. And it must be admitted in the present state of our knowledge of this disease in mammals and birds that the appearance of tuberculosis in a flock of chickens or other poultry opens up for that locality all the questions connected with this malady.

Rivolta, Straus, and other writers early demonstrated the fact that after tubercle bacilli have been retained for generations in the

tissues of fowls they will not readily affect mammals. Conversely, mammalian tubercle bacilli are said to affect fowl very infrequently; in fact, many noted bacteriologists affirm most positively that it is utterly impossible by any manner of infection or inoculation to infect fowls with mammalian tubercle bacilli. It becomes, therefore, of interest to investigate any case in which tuberculosis seems to have been conveyed by natural means of transfer from birds to mammals, or vice versa. It is furthermore very interesting to study the relations between tubercle bacilli from various species of animals and to make test inoculations upon all available species of laboratory animals with as many varieties of cultures as may be obtainable.

HISTORY OF THE PRESENT INVESTIGATION.

The occurrence of an outbreak of tuberculosis among the poultry on a ranch in Oregon which seemed to be extending to the swine of the same farm, causing many of them to be condemned as tuberculous when inspected at the abattoir, presented an opportunity for inaugurating a systematic study of this outbreak, especially in regard to the transmissibility of the disease from the birds to the hogs that were kept near them upon the home ranch, and also to other mammals experimentally.

This outbreak was called to our attention by Dr. S. W. McClure, an inspector of this Bureau located in Oregon, in the following report:

> The history of this infection is somewhat interesting. About one year ago Mr. B. had 65 grown chickens; one or two of them were noticed to be sick, and, after a lingering illness, died. About three months later other members of the flock became affected and died in the same manner. Altogether about 30 of the 65 died during the last six months, several of which were examined by the owner and found to be in the same condition as those which we examined. He now has remaining less than 20 of his original flock, and most of them are affected with the disease. These chickens are in the yard with about 30 hogs, and those that have died have been consumed by the hogs. He has slaughtered some of the hogs lately and has found their livers affected exactly similarly to those of the chickens.

The facts shown in this letter and reports from a neighboring abattoir which confirmed the presence of tuberculosis in the swine made further investigation desirable, especially as there was nothing in the history of the outbreak among the hogs to indicate that they derived their infection from tuberculous cattle or their products. Several fowls were therefore secured and shipped to the laboratory at Washington. The following letter accompanied them:

> The four hens forwarded were secured from the ranch of Mr. B. referred to in my previous letter. These are all the chickens that he has left. On my earlier visit to this ranch I found hens that presented no physical symptoms whatever, and yet they showed on post-mortem the advanced lesions of tuber-

culosis. Mr. B.'s turkeys all died of tuberculosis. The turkey that is included in this shipment was secured from an adjoining ranch owned by Mr. R. Mr. R.'s chickens mix with the chickens of Mr. B., and a great many of them were tubercular and have been killed. His turkeys had all died except the one which I am forwarding.

Some of the affected livers from the tuberculous swine were obtained at the abattoir and were mailed to the laboratory at Washington, where attempts were made to study the character of the bacilli which caused the lesions. Owing to the distance that it was necessary to send these specimens the bacilli could only be studied as to their morphology after their arrival at the laboratory, as the material (formalin) in which they were packed made cultivation impossible.

The morphology presented by the tubercle bacilli from the hog specimens upon examination offers by no means a satisfactory basis upon which to support their classification. The form of tubercle bacilli may be changed so quickly by alterations in their surroundings that we believe that no decision as to the type of any particular specimen of tubercle bacilli should ever be given until more extended observations have been made. Hence the experiments mentioned below, made by feeding these infected fowls to hogs and obtaining well-defined cases of hog tuberculosis, serve to complete the evidence which could not be obtained from the hog tissues forwarded.

FEEDING AND INOCULATION EXPERIMENTS.

There was not much in the general appearance of the fowls on their arrival at the laboratory to give one a suspicion that they were sick. They were all adult Plymouth Rocks, with evident good appetites, and they moved about in a strong, active manner. With two of them, however, it was noticed that their combs and wattles were not quite so bright as they should have been. These two birds were selected for the beginning of the test. They were killed and examined, and then, in order to make the experiment correspond as closely as possible with the conditions under which the disease had apparently been transmitted from fowls to hogs in Oregon, the viscera were at once fed to two young tuberculin-tested pigs between 2 and 3 months of age.

At the autopsy of hen No. 1 the spleen was found to be about three times its normal size and thickly covered with tuberculous nodules. The liver was thickly sown with small white foci, and tubercular foci were found in the lymph glands of the intestinal tract, but in this case no lesions were noted in the intestinal walls.

Hen No. 2, on examination, was found to have spreading tuberculous growths varying from 1 to 8 millimeters in diameter scattered about in the liver. These had the appearance of actively progressing

lesions. The spleen was about twice the normal size and thickly studded with tuberculous nodules. With this bird the infection was extensive along the intestinal tract, the intestinal walls supporting numerous tuberculous nodules from the size of millet seeds up to the size of beans. These growths appeared upon all parts of the intestines, except over some 8 inches of the posterior part. The nodules were quite firm in consistence, none of them showing any tendency toward pus formation.

In neither of the birds was there any affection of the lungs, ovaries, or oviducts.

The viscera from these two hens were fed to pigs Nos. 2399 and 2400 on October 14, 1908. On January 26, 1909, or one hundred and four days later, the animals were chloroformed and examined, when the following conditions were noted:

Pig No. 2399 was in prime condition. Section showed many small white tuberculous foci scattered about in the submaxillary glands, which were somewhat enlarged. No lesions were detected in the prescapular glands or in any organs of the thoracic cavity. On opening the abdominal cavity a large proportion of the mesenteric glands proved to be caseous, while the liver was found to contain numerous small white foci of tuberculosis and had become adherent to the abdominal walls by means of tuberculous growths over an area some 5 by 8 centimeters in diameter. Further examination with the microscope showed that the spleen also contained many tubercle bacilli collected in small groups, yet without forming visible necrotic centers.

The other pig, No. 2400, was also in excellent condition. Its submaxillary glands were greatly enlarged and contained many tuberculous foci, some of which were softening and breaking down. The mesenteric glands showed very general infection. Tubercle bacilli were found to be numerous in all the affected glands.

Here was the demonstration that was necessary to connect avian with porcine tuberculosis, and there seems to be no room for reasonable doubt that the condemned tuberculous hogs from the Oregon ranch owed their infection to the ingestion of the carcasses of the affected hens, just as the two hogs in the test at the laboratory contracted their infection unquestionably through feeding upon the two birds. It was, furthermore, a proof that danger to mammals may exist wherever tuberculous birds are present.

From the affected organs of the pigs cultures were obtained through feeding and inoculating chickens, rabbits, and guinea pigs, and then transferring the tuberculous tissues so obtained to artificial culture media. These cultures were found to conform to the avian type of tubercle bacilli in morphological and biological characteristics.

OCCURRENCE OF TUBERCLE BACILLI IN EGGS OF TUBERCULOUS HENS.

The two hens left of the original Oregon shipment were retained in the laboratory for several weeks after the first two had been used in feeding experiments. On January 6 an egg was found in their cage which seemed to be perfectly formed in every way. It was carefully opened aseptically at the larger end and numerous smears were made of its contents. No tubercle bacilli could be determined by these means, so recourse was had to guinea-pig inoculation. The syringe was carefully filled with white of the egg without disturbing the yolk, and two guinea pigs were at once inoculated intra-abdominally. Following this the process was repeated on other guinea pigs, using the yolk as material for injection.

Thirty-six days after these inoculations one of the guinea pigs that had received a portion of the white of the egg died. On examination a degenerated area some 5 by 20 mm. was found between the muscular layers of the abdominal walls. This area appeared inflamed and contained numerous small yellowish-white foci, in which, on microscopical examination, numerous tubercle bacilli were found. The spleen of this guinea pig was enlarged to fully three times its natural size and was considerably darkened in color. No tuberculous foci were visible in this organ, but the presence of tubercle bacilli was readily demonstrated by means of smears. The carcass of the guinea pig was in excellent condition, showing no emaciation.

The other guinea pig which received an inoculation with white of egg died on the forty-third day, and although no tuberculous foci were determined, the spleen and the mesenteric glands contained such numbers of tubercle bacilli as to produce well-marked lesions in guinea pigs subinoculated with them. From these lesions typical avian cultures were recovered upon egg media.

The guinea pigs receiving yolk inoculations failed to develop tuberculosis after observation for sixty-eight days, followed by autopsy.

On March 24 another egg was laid by one of the hens, but this egg was not quite normal in appearance and would at once attract the attention of the poultryman because of its diminutive size and because its contour formed a perfect oval, neither end being materially broader than the other. On opening this egg the yolk was found to be very small in size and of a pale yellowish-white color. As in the preceding instance, no tubercle bacilli could be demonstrated by microscopical examination, and 4 guinea pigs were at once inoculated with the white and the yolk separately. Fifty-eight days after inoculation these guinea pigs were chloroformed, when it was found that one of the two animals that had received inoculation with the white of the egg had developed evidence of tuberculosis. The spleen

contained a few small tuberculous nodules, while the liver, kidneys, pancreas, and mesenteric lymph glands showed the effects of the disease by swelling, congestion, and the presence of tubercle bacilli. The other guinea pig of this series was found to be perfectly normal.

The hen which laid the infected eggs was killed on April 13 and examined. She was in good condition, her tissues being well covered with fat. The abdominal cavity contained an excess of serous fluid. The liver supported several dense, hard nodules. The intestines showed numerous tuberculous nodules scattered about on the surface of their walls over the anterior portion of the intestine, or down to its juncture with the ceca. The mesentery presented over much of its surface an inflamed area thickly sown with small tuberculous nodules. The membrane of the oviduct was similarly inflamed for 2 inches or more above its opening at the vent, but here the nodules mentioned as present on the mesentery were lacking. The spleen contained many foci of tuberculosis, ranging in size from a mere point up to the dimensions of a millet seed. The kidneys were surrounded by delicate lines of tuberculous nodes, pinhead size, but the organs themselves were not affected. The lungs contained pronounced tuberculous lesions. In the left lung four foci were noticed that reached about 3 millimeters in diameter, while the right lung supported only one small node the size of a millet seed.

Smears were prepared from the various affected organs, especial attention being given to the oviduct, as it was fairly evident that the inflamed tuberculous surface of this organ must have been responsible for the infection of the egg with which we had been working, and the detection of tubercle bacilli by means of microscopic examination of scrapings from its surface confirmed this view. Tubercle bacilli were present in these scrapings in very small numbers, but from the readiness with which guinea pigs were infected by means of inoculation it seems probable that the eggs must have become quite thoroughly infected at some stage of development, probably during their intimate contact with the inflamed membrane of the oviduct.

Cultures were readily obtained from the tissues of the guinea pigs which had become tuberculous through the egg inoculations. In every case the cultures grew in a manner characteristic of avian tubercle bacilli. From hen No. 3, the one just described as having a diseased oviduct, similar cultures were obtained directly upon glycerin agar without having recourse to animal passage.

RÉSUMÉ OF PREVIOUS INVESTIGATIONS.

Long before the discovery of the tubercle bacillus scientists had been interested in the study of tuberculosis in poultry but had been unable to determine definitely the real nature of the whitish nodules

which they had occasionally noticed upon the visceral organs of fowls. In 1882, however, Koch proved through the discovery of tubercle bacilli within these nodules that they were of tubercular origin.

During later years considerable study has been given to the question of the relation existing between avian and mammalian tubercle bacilli. Probably the most extensive article resulting from investigations of this nature is the report of Weber and Bofinger, of the Imperial Health Office of Germany, which appeared in 1904. These writers are very positive that fowls can not possibly be infected by mammalian tubercle bacilli, no matter how applied. They are equally positive that no transformation ever occurs, either of avian tubercle bacilli during a stay in the body of a mammal or of mammalian tubercle bacilli when supported by the tissues of a bird.

During their investigations they received a tuberculous pig which on examination proved to have been infected by avian tubercle bacilli. The cultures recovered from this pig assumed the manner of growth which is characteristic of tubercle bacilli of the avian type immediately on isolation, and continued to manifest these characters of growth through several subsequent generations. In the results which they obtained from the examination of this pig they fully substantiate findings reported by the present writers, for in both instances pigs were proven to have become tuberculous by natural means of infection through contact with avian tubercle bacilli.

A report by Rabinowitsch, also issued in 1904, in which are recorded the findings of autopsies made upon 55 birds from the Berlin Zoological Gardens and the conclusions derived from careful study of cultures obtained from them, furnishes most valuable information regarding the relations of avian with mammalian tubercle bacilli. In two cases tubercle bacilli of the mammalian type were recovered from fishhawks. As other birds of the same species were found to be infected with avian tubercle bacilli, it seems justifiable to class fishhawks with parrots in the sense that both of these species of birds are susceptible to infection by either type of tubercle bacilli.

Rabinowitsch also succeeded in producing tuberculous lesions in two hens through feeding them with pure cultures of tubercle bacilli of human origin, but owing to the fact that no cultures were recovered from the bodies of the fowls afterwards some investigators are inclined to dispute the success of the experiment.

Important variations in the virulence of the various avian cultures were noted, a fact which has been fully substantiated by our work, and a condition which is quite in conformity with the variations found in cultures of other bacteria.

By extending her investigations a number of rats and mice that were caught in the birds' quarters of the Berlin gardens were found in several instances to have contracted tuberculosis. Conversely it was learned that the birds would eat the affected carcasses of the rats and mice and contract tuberculosis by that means, and in this manner the rodents served to spread the infection materially.

In 1908 Dr. Oluf Bang reported the results of a number of tests made for the purpose of determining the susceptibility of birds for mammalian tubercle bacilli and also the extent to which mammals could be infected with tubercle bacilli of the avian type. Bang tested 18 mammalian cultures carefully in regard to their pathogenicity for fowls, and found 12 that were capable of causing tuberculous lesions in hens, while 6 were harmless by any of the means commonly used for inoculation.

The results obtained in attempts to infect mammals by using avian tubercle bacilli were also successful in proving that young kids, calves, and foals possess considerable susceptibility for these organisms. He also found that continued retention of mammalian tubercle bacilli in the tissues of birds altered their pathogenicity for guinea pigs, as they gradually became less virulent for these animals.

The present writers in 1906 reported the successful inoculation of guinea pigs, rabbits, and a cat with avian tubercle bacilli, and also noted a profound alteration in the pathogenicity and cultural characteristics of the culture used, until at last it would cause well-defined tubercular necroses within the viscera of the guinea pigs, instead of merely a general congestion of the visceral organs, as was the case at first. Instead of spreading uniformly over the surface of the serum in a moist white layer, as at the beginning of the experiment, the recovered cultures appeared to increase in growths of small whitish clumps, somewhat similar to the manner of growth common to tubercle bacilli of the human type, except that the clumps were slightly flatter.

Since the publication of the experiments just mentioned, some criticism of the culture which was used in the tests has been noted. The objection has been made that the avian culture used in our experiments was not examined to see if it was pathogenic for fowls. The writers made the statement that this culture "is well known to bacteriologists and is accepted by most of them as meeting all the requirements of tubercle bacilli of the avian type." This statement obviously includes its pathogenicity for fowls, and this fact was fully proven by the inoculation of chickens, which resulted in the production of well-marked lesions of tuberculosis, one of the birds inoculated developing a very typical tuberculous tumor upon one of its joints in addition to the lesions of the abdominal viscera.

RELATIONSHIP OF DIFFERENT TYPES OF TUBERCLE BACILLI.

The greatest interest attaches to the relationship of tubercle bacilli as found in their various hosts. This relationship between the tubercle bacilli recovered from the various species of mammals, birds, fishes, and reptiles is certainly very intimate. It may be that the slight differences which may now be demonstrated between the different types of tubercle bacilli have been of slow development, and due to their environment and to differences in the temperature at which they have been forced to live, or to differences in the amount and quality of nutrition with which they have been supplied. Whatever the variations between the types, they are not great enough to prevent the successful interchange of tubercle bacilli by means of inoculations between representative hosts of the several types.

The slow but gradual transformation of certain growths of tubercle bacilli should not be considered such an impossibility. Other forms of bacterial life yield to the peculiar influences of their environment, and why should not the tubercle bacillus be equally susceptible to change? The attenuation of the *Bacillus anthracis* by submitting it to elevated temperatures, and the prompt recovery of its primary virulence by passage through a white mouse, affords a notable instance of the manner in which one of the most dangerous and active pathogenic micro-organisms may be transformed. The diphtheria bacillus becomes promptly attenuated by the addition of a small amount of iodin trichlorid to the nutrient medium in which it is growing. Swine erysipelas becomes much less virulent by repeated passage through rabbits. The *Streptococcus pyogenes* and the bacillus of Asiatic cholera rapidly become affected while growing artificially, through the action of the products of their own growth, and unless removed frequently to fresh nutriment they will gradually weaken and die.

Since, then, it must be admitted that there are many forms of pathogenic micro-organisms that can be materially altered by increase of heat to their surroundings, by the application of the direct rays of sunlight, by increasing or decreasing the acidity or the alkalinity of their nutriment, by the influences of the products of their own growth, and by passage through animals either susceptible or resistant to their action, is it too much to suppose that tubercle bacilli may also be altered in form, virulence, and in vigor of growth when cultivated under unusual conditions? Experiments have shown that some tubercle bacilli may be transformed in form, pathogenicity, and cultural characteristics as well. More than this, cultures which seem incapable of attacking certain species of test animals with the degree

of severity which one would expect in view of their average virulence for animals of other species, may be brought to change their peculiar affinities until they will prove virulent for a species of animal formerly resistant.

Until a few years ago tubercle bacilli were grouped for all practical purposes into two classes—mammalian and avian; the former were found in man and other mammals, while the latter were isolated from birds.

The experiments which were made by the writers[a] in a comparative study of tubercle bacilli from various sources have demonstrated that the mammalian bacilli are distinguished from other forms of bacilli chiefly by a higher degree of virulence as well as by certain less important morphological and cultural characteristics; but it was likewise found that there are also tubercle bacilli of avian origin which can not be distinguished from those derived from mammals. Furthermore, these differences are not constant, for transition forms are observed in different hosts which are not typical of the forms usually peculiar to that host. Nor is the virulence of the bovine, human, and avian bacillus always the same, but it varies within a wide range. In fact, the virulence of certain bacilli from both mammals and birds has been found to become accentuated in consequence of passage through a series of animals, and, on the other hand, the pathogenesis has been diminished by long development on artificial culture media. Therefore tubercle bacilli should be regarded as polymorphic organisms of a single species of bacteria which have become differentiated by their environment in the different hosts, and the variations which afterwards form among individual varieties are transitory forms which have not had sufficient time or proper nutriment to become transformed into the typical varieties.

The fact that tubercle bacilli of one species may be transmitted to an animal of a different species, or to man, makes it apparent that any preventive methods for controlling tuberculosis, to be successful, must take into consideration all species of animals which are susceptible to this infection.

SUMMARY AND CONCLUSIONS.

An outbreak of tuberculosis among the fowls on a large ranch in Oregon that seemed to extend to the swine of the same farm through feeding the hogs upon the carcasses of fowls that succumbed to the disease led to the inauguration of a series of experiments designed to

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[a] Bulletin 96, Bureau of Animal Industry. Twenty-third Annual Report, Bureau of Animal Industry, 1906, page 113.

ascertain if the bacilli of avian tuberculosis may be transmitted to mammals under suitable conditions.

Four living hens were obtained from the infected ranch. Two of these were fed to a pair of tuberculin-tested pigs between 2 and 3 months of age. After a period of about fifteen weeks the pigs were killed and carefully examined, when it was found that both of them had developed marked cases of tuberculosis. In both instances the submaxillary and mesenteric glands were visibly affected, while one of the animals had numerous tubercle bacilli in the spleen and liver.

The affected tissues of these two experiment pigs were at once used in the execution of other experiments. They were fed to healthy fowls and were administered in various ways to guinea pigs and rabbits to test their virulence for mammalia. Cultures were quickly obtained from these inoculations, all of which proved to be avian in their biological characteristics.

Interesting investigations of eggs from the diseased hens led to very unexpected results. During the five months immediately following the arrival of the hens at the laboratory only one egg was laid, probably because of the unthrifty condition of the birds. A second egg was laid subsequently. Microscopic examination of these eggs failed to disclose the presence of tubercle bacilli, but the inoculation of guinea pigs proved their presence. Several guinea pigs were inoculated with the white of the egg and others with the yolk. Those which received inoculations of the yolk failed to develop tuberculosis, but those which were injected with the white, with one exception, developed very characteristic lesions within a short period.

By means of this series of experiments and others that have been previously made with avian tubercle bacilli it has been proved that the micro-organisms of naturally acquired tuberculosis in fowls can be made to lodge and multiply within the tissues of swine, cats, rabbits, and guinea pigs. They will cause progressive wasting and death in guinea pigs without producing characteristic necrotic foci in the organs, although recourse to the microscope reveals the presence of vast numbers of tubercle bacilli in the lungs, spleen, liver, or kidneys.

Repeated passage of such avian tubercle bacilli in large numbers from animal to animal will result in the final development of a type of tubercle bacilli which will produce typical lesions of tuberculosis in mammals.

The carcasses of tuberculous fowls should never be fed to swine, as the latter may contract tuberculosis from such food. Eggs produced by tuberculous fowls should be considered dangerous until cooked, as they may harbor tubercle bacilli in important numbers.

Thriving cultures of avian tubercle bacilli were readily obtained directly from the affected tissues of the fowls by planting upon glycerin agar and egg media as well as after passage through laboratory animals.

Tubercle bacilli of one species may be transmitted to an animal of a different species, which fact makes it apparent that, to be successful, any preventive methods for controlling tuberculosis must take into consideration all species of animals that are susceptible to this infection.

FIELD TESTS WITH SERUM FOR THE PREVENTION OF HOG CHOLERA.

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INTRODUCTION.

Experiments which had for their object the production of immunity from hog cholera were carried on by the Bureau of Animal Industry during the years 1903–1906. These experiments, which were described in Bulletin 102 of the Bureau of Animal Industry,[a] demonstrated that shotes weighing from 25 to 75 pounds could be successfully immunized by the use of hyperimmune [b] serum alone or by the simultaneous use of the serum and virulent hog-cholera blood. This much having been proved, it remained to test the practical value of this method under normal farm conditions, and it seemed very desirable in this connection to learn what could be accomplished by treating animals of different ages, located on farms in different localities, and kept under varying field conditions.

Early in the fall of 1907 the conditions were favorable for an extensive practical test; that is to say, a considerable quantity of hyperimmune serum had been prepared, virulent hog cholera had appeared in several neighborhoods not far distant from the Bureau station (near Ames, Iowa), and the farmers were anxious to cooperate in testing the serum treatment. The work of testing the serum treatment under practical conditions was consequently undertaken.

The field tests were planned to gain information on at least three important points: (1) To determine what could be accomplished toward diminishing the loss in a herd in which hog cholera had already appeared; (2) to ascertain what could be gained by treating a healthy herd after it had been exposed to the disease, but before any hogs had become sick; and (3) to determine whether the spread of

[a] "Further Experiments Concerning the Production of Immunity from Hog Cholera," by M. Dorset, C. N. McBryde, and W. B. Niles.

[b] The term "hyperimmune," used in this paper, refers to a hog, already immune to hog cholera, whose immunity has been increased by the injection of large doses of blood from hogs affected with hog cholera. Similarly, "hyperimmune serum" means the serum procured from the blood of such hyperimmune hogs.

10765—10——12

hog cholera could be arrested by treating all healthy herds on farms bordering on a center of infection which had not been exposed to the disease at the time of treatment. It was, in addition, considered desirable to test the effect of the treatment on old hogs and on sucking pigs, also to determine the size of dose for hogs of different ages, and whether the possibility of causing disease by the simultaneous use of hyperimmune serum and disease-producing blood would render the simultaneous treatment of uninfected herds impracticable.

Before discussing the various phases of the experiments which were carried out to determine these points we will refer briefly to the material used in the vaccinations.

THE FIELD TESTS.

DESCRIPTION OF SERUM USED.

All of the serum used in the experiments described in this paper was prepared in accordance with the methods described in Bulletin 102. It will be remembered that this serum is prepared by injecting immune hogs with virulent blood obtained from hogs sick of hog cholera. The virulent blood is usually injected subcutaneously into the immune.

Two methods of hyperimmunization are employed, known as the "slow method" and the "quick method." The slow method consists in the injection of three successive doses of disease-producing blood. For the first dose 1 c. c. of disease-producing blood is given for each pound of body weight. After an interval of about a week, 2½ c. c. of virulent blood for each pound of body weight is administered, and after a second interval of a week, 5 c. c. of virulent blood for each pound of body weight is given the immune. The hog is then allowed to recover completely from the last injection, which usually requires about ten days; blood is then drawn and defibrinated, and the serum is ready for the treatment of nonimmune animals.

The second method of hyperimmunization—the quick method—consists in administering to an immune hog at one time 10 c. c. of disease-producing blood for each pound of body weight. The animal is allowed to recover from the effects of the injection, and its blood is then drawn and the serum used for the treatment of nonimmunes.

Blood is drawn from the hyperimmune animal by cutting off its tail. Several bleedings are made at intervals in this way. We thus have what are known as the first, second, third, and fourth drawings of blood from the hyperimmune.

In order to avoid the needless labor and expense which would have resulted had the serum from each hyperimmune been tested separately, it was decided to mix the serum obtained from several different hyperimmunes and then test the mixture. Such mixtures were

designated "mixed serum No. 1," "mixed serum No. 2," and so on. The potency of the different mixed serums was determined by injecting small pigs with 15 to 20 c. c. of the serum together with 2 c. c. of disease-producing blood, the virulence of the latter being tested by injecting check pigs with a similar dose at the same time. If the pigs which received serum in conjunction with the disease-producing blood survived and those which received disease-producing blood without serum died, the serum was regarded as efficient, or potent.

In the tests to be described later, five different mixed serums, numbered from 1 to 5, were used. These five mixed serums consisted of serum obtained from different immunes, as follows:

Mixed serum No. 1 consisted of the first and second drawings of blood from two hogs hyperimmunized by the slow method. These hogs were hyperimmunized early in the season, and as some tested serum was needed for special experiments, the first and second drawings of blood were mixed, tested, and used for these experiments. Mixed serum No. 1 represented, therefore, only two drawings, and the amount of this serum consequently was small.

Mixed serum No. 2 was drawn during July and August, 1907, and consisted of the total serum secured from eight hyperimmune hogs, four of which were hyperimmunized by the slow method and four by the quick method. Each of these hogs was bled three times from the tail at intervals of one week. One week after the last bleeding they were bled to death from the carotid artery. They ranged in weight from 100 to 225 pounds at the time hyperimmunization was begun, and the total amount of serum obtained from them was 30,698 c. c., or an average of about 3,800 c. c. from each animal.

Mixed serum No. 3, drawn during August and September, 1907, was the total product from four hogs hyperimmunized by the slow method. Their respective weights when first injected with the disease-producing blood were 100, 200, 220, and 325 pounds, and the total amount of serum obtained was 17,877 c. c., or an average of 4,469 c. c. from each hog. It is of interest to note that the immune hog weighing 325 pounds required a large amount of disease-producing blood for hyperimmunization and was too large for convenient handling, but yielded a very large amount of serum, a total of 5,641 c. c. being secured; the three tail bleedings yielded about 1,000 c. c. each, and 2,600 c. c. was obtained from the carotid artery when the animal was killed. While the amount of hyperimmune serum secured from these four animals was large, it was shown by tests to be up to the standard in potency.

Mixed serum No. 4 consisted of small lots of serum secured from several hyperimmune hogs. As the serum supply at the station was running low and there were numerous demands for the vaccination of

herds in different parts of the county, it was decided to mix and test the numerous small amounts of serum on hand. The mixture contained (1) a considerable quantity of serum prepared in 1906, consisting of a small amount each of second, third, fourth, and fifth tail drawings from eight immune hogs, four of which had been injected with disease-producing blood by the slow method and the others by the quick method; (2) the carotid, or last, drawing of blood taken from three hyperimmune hogs in July, 1907, together with the fourth tail drawing of blood from two of these; and (3) a few odd lots of serum left over from previous experiments. Approximately one-half of the mixture was prepared in 1906 and the remainder in 1907.

Notwithstanding the fact that No. 4 serum consisted in great part of serum more than one year old and a considerable part of it was carotid blood without the corresponding tail drawings, it proved potent when used on experimental shotes at the station and also for the vaccination of herds in the field, as will be shown later.

Mixed serum No. 5 was drawn in October and November, 1907, and represented the total amount of serum secured from two hogs hyperimmunized by the quick method. The animals were bled three times from the tail and then from the carotid artery, as was done in the case of the hogs from which serum No. 2 was obtained. The weights of the two hogs were 150 and 160 pounds, respectively, and the total amount of serum secured was 8,676 c. c.

DISEASE-PRODUCING BLOOD USED.

The virulent blood used in the field tests of the simultaneous[a] method was, in most instances, the same as that used at the Bureau station for the hyperimmunization of the immunes. This blood was used for the field tests soon after it was drawn, or else was preserved in sealed glass bulbs which were held for a few days at ice-box temperature. All of the disease-producing blood used in the field tests proved sufficiently virulent to kill check animals in doses of 2 c. c., save in the case of one lot, which failed to kill the checks in the dose just stated, but rendered them immune on exposure, as was shown later.

LOCATION OF THE EXPERIMENTS.

It will be seen by referring to the map (fig. 22) and to the records of the herds described hereafter, that we were fortunately able to treat hogs on 47 different farms, located in 9 townships and 12 different localities. Many of the herds were in an infected region, which covered a considerable extent of territory, about 10 miles

[a] In describing the field tests the use of serum alone will be referred to as the "serum" method, while the use of serum in conjunction with disease-producing blood will be referred to as the "simultaneous" method.

southeast of Ames, Story County, Iowa. A few were located to the west of Ames, on the edge of Boone County, 20 miles or more from the locality just mentioned, and the rest were a considerable distance from the Bureau station in other directions. The territory covered by the experiments is sufficiently large to show that the infection responsible for the outbreaks came without doubt from different sources.

A few of the herds were made up of purebred animals and received extra care and attention from their owners, but the majority were ordinary farm herds, which were cared for in the usual way. All of

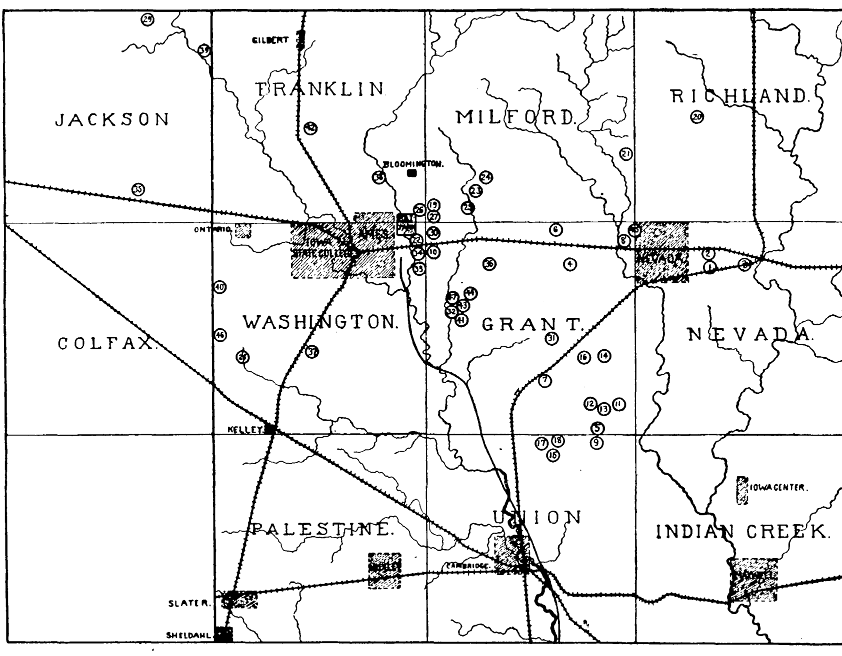

FIG. 22.—Map of portions of Boone and Story counties, Iowa, showing townships and locations of herds treated for hog cholera.

the leading breeds were represented in the herds treated, and no difference in results could be noted for the different breeds. In this connection it is of interest to note that the treated herds received the same care after treatment as before. The sick animals were not isolated from the healthy ones, and no attempt was made to disinfect premises. The good results obtained may be attributed, therefore, entirely to the serum treatment.

A study of the disease in the different neighborhoods visited shows a marked similarity of symptoms and lesions, which, considered in connection with the uniformity of results, goes to show that we were dealing with one disease only, and also strengthens the writer in the

opinion he has for some time held that when hogs are once immunized against hog cholera but little need be feared from so-called "swine plague."

DESCRIPTION OF TESTS.

As already stated, the field tests covered a considerable area of territory and included the treatment of purebred hogs of different breeds, kept under the most favorable conditions, as well as herds kept under the prevailing farm conditions. In the section where the experiments were made swine raising is a very important industry and every farmer raises a considerable number of hogs every year notwithstanding the fact that hog cholera may have thinned out his herd the previous year, the number of breeding animals being maintained by purchase if necessary. The almost universal custom of raising hogs, together with the fact that the hog pastures on different farms are often adjacent, tends to favor the spread of hog cholera when it has once started in a neighborhood.

In Story County, Iowa, and the adjoining counties the hog-cholera record for 1907 is similar to that of many previous years. The disease began quite early in the summer in a few localities and gradually spread until before the close of the season a large extent of territory was involved. The demand for vaccination was very great and only a small number of the farms whose proprietors requested treatment could be visited.

MORTALITY IN UNTREATED HERDS.

While the high mortality among the untreated checks in the herds visited tends to show that the disease encountered was extremely virulent, the outcome in a few untreated herds located in the vicinity of those treated may also prove interesting. A farmer living in the suburbs of Nevada, Iowa, whose herd consisted of 205 hogs of different ages at the time the disease appeared in that vicinity in August, lost all but 3 old sows and 8 shotes. In a herd of 30 head located across the highway from treated herd No. 6, 22 died. A neighbor of the owner of treated herd No. 5 had 35 shotes and lost all but 6. In the same neighborhood in a herd of 37 hogs all died but 3. In the neighborhood of treated herd No. 45 one owner of over 100 head lost the entire number. Another lost 33 out of a herd of 36, and still another lost something over 50 per cent of his herd. The owner of treated herd No. 1 before the experiment was started on his farm had lost something over 90 per cent of his herd. In Boone County, Iowa, in the neighborhood of treated herd No. 29 a farmer having 24 head at the time the disease appeared lost 20.

The records of the untreated herds just given show a virulent type of disease, and autopsies on dead animals in untreated herds and on untreated checks in treated herds showed the characteristic lesions of hog cholera.

RECORDS OF HERDS TREATED.

Herd No. 1.

Herd No. 1 was located in the northwest quarter of section 9, Nevada Township, Story County, Iowa. At the time it was first visited the owner had lost 90 head out of a total of 100, or very nearly his entire herd. The symptoms and lesions were those usually seen in hog cholera. Arrangements were made with the owner to carry out a test of the serum on his farm. For the test 13 small shotes, weighing from 35 to 40 pounds each, were purchased. These had not been previously exposed to hog cholera. Ten were injected with 20 c. c. each of mixed serum No. 1, and the remaining 3 were left untreated to serve as checks. The entire number were then confined in the hog house together with some of the sick shotes from the original farm herd. The experiment was started September 9, and ten days later the checks showed indications of disease. When seen on September 25 one of the checks was dead and the other two were very sick, with the usual cholera symptoms. On September 30 all of the checks were dead. All of the treated pigs continued well except one, which showed slight soreness of the eyes. Later observations showed that the treated pigs were well and thrifty. The result of this experiment became widely known in the surrounding country and led to many demands for the treatment of affected herds.

Herd No. 2.

Herd No. 2 was located on the opposite side of the road from Herd No. 1, and consisted of an old sow and her litter of 5 shotes weighing about 75 pounds each. These animals, although close to infected premises, had remained well. The owner was present when the experiment with Herd No. 1 was carried out, and thinking that his pigs were in danger of infection, desired to have them treated. Three of the pigs were accordingly injected with 20 c. c. each of mixed serum No. 1 together with 2 c. c. of virulent blood. The other two were left untreated as checks.

As both the checks and the treated pigs remained well, we must conclude that exposure did not occur in this instance. The experiment is of interest, however, as it shows that three 75-pound pigs remained well after receiving the serum-simultaneous treatment, and that these pigs did not communicate disease to the untreated pigs which associated with them.

Herd No. 3.

Herd No. 3 was located one mile east of Herd No. 1 and probably became infected through the extension of the disease from that herd. When the herd was first visited on September 14, 1907, two old sows

had died and a number of late-summer pigs were showing symptoms of the disease. Some of the spring pigs also seemed somewhat affected. The sick pigs showed the usual hog-cholera symptoms, including diarrhea. An autopsy on an old sow which had just died revealed hog-cholera lesions. Untreated checks which died after the experiment was begun also showed the usual symptoms and lesions of hog cholera.

Fifty-one of the spring shotes weighing from 30 to 50 pounds each were selected for the test. Two-thirds of the number, or 34, were injected with 20 c. c. each of mixed serum No. 2, and the remaining 17 were left untreated as checks. Two old sows and 1 large boar were treated with 40 c. c. each of the same serum. The sows had young litters which were not treated. The summer shotes and a few of the spring pigs were left untreated in addition to the 17 mentioned.

The results in this herd exceeded our expectations. Of the 34 treated shotes 6 sickened soon after treatment and died; some of these, however, were probably sick when treated. The other 28 continued well. Of the 17 checks but 2 survived, while all of the summer and spring pigs which were left untreated died. The boar sickened, but recovered. The 2 old sows did not sicken, but their young pigs all died. Had the entire 51 selected for the experiment been treated the loss in this portion of the herd would probably have been very small.

HERD NO. 4.

Herd No. 4 was located in the northwest quarter of section 11, Grant Township, Story County. When first seen on September 25, 1907, the herd was apparently well, although the disease had for some days been within half a mile of the farm. The herd consisted of 30 spring shotes, each weighing from 75 to 100 pounds, and 3 old sows with young litters.

In planning the experiment the intention was to treat all of the animals except the sucking pigs, but in collecting the spring shotes for treatment one escaped and could not be treated. Consequently 29 shotes and 3 old sows were treated, the shote which escaped and the sucking pigs being left as checks. The shotes each received 20 c. c. of serum No. 2, plus 2 c. c. of virulent blood, and the old sows were given 40 c. c. each of serum, plus 2 c. c. of virulent blood. The herd was treated on September 25.

On the following day one of the treated shotes appeared somewhat droopy, and two days later one of the old sows became sick, showing loss of appetite and other symptoms. The sow became worse and died nine days after treatment. The autopsy showed the usual hog-cholera lesions—engorged spleen, congested liver, hemorrhages in kidneys, and well-marked ulceration of the cecum and colon. The droopy shote became worse and finally died. The check shote and

all of the sucking pigs also died. The other 28 shotes and the 2 old sows remained well and thrifty.

In this experiment we must conclude that the herd had been exposed to hog cholera before treatment, since repeated injections of virulent blood have shown that it would have been impossible for the serum-simultaneous treatment to have caused disease within one day after treatment. Therefore the shote which died was undoubtedly sick at the time of treatment. The experiment shows that large 100-pound shotes which received 20 c. c. of serum were able to withstand 2 c. c. of virulent blood administered at the same time.

Herd No. 5.

Herd No. 5 was located in the southeast quarter of section 35, Grant Township, and was first seen on October 4, 1907. At this time one shote had died but the rest of the herd appeared healthy. An autopsy on the dead shote revealed the characteristic lesions of hog cholera—hemorrhages in the lungs and kidneys, engorged spleen, enlarged lymphatic glands, and ulceration of the cecum.

Thirty-nine spring shotes, weighing from 40 to 60 pounds each, were injected with 20 c. c. each of serum No. 2. Eight shotes of the same size were left untreated as checks. Five old sows received 40 c. c. each of the same serum; each of these sows had litters, the total number of sucking pigs being 30.

Four of the 8 check shotes sickened and died, and 2 others sickened but recovered from the disease although they remained in poor condition. Two of the treated pigs died and the other 37 remained well and thrifty. The old sows remained well, but all of the sucking pigs died but 4. When we consider the results with this herd it seems probable that the loss would have been very light had the entire herd been treated.

Herd No. 6.

Herd No. 6 was located in the northeast quarter of section 3, Grant Township, and probably became infected from a diseased herd just across the road. When seen on October 5, 1907, one shote was reported as having been sick for three days; this animal appeared droopy and was not eating well. Another animal seemed a little indisposed, but the remainder of the herd appeared well. All of the animals ran together in the same yard and pasture.

Twelve shotes, ranging in weight from 40 to 70 pounds and including 2 sick animals, were left untreated as checks. The remaining 67 animals received the serum-simultaneous treatment, each shote being given 20 c. c. of No. 2 serum, plus 2 c. c. of virulent blood.

Of the 12 untreated shotes 8 died after exhibiting the usual hog-cholera symptoms; 2 others sickened and recovered, but remained in a

stunted condition. Of the 67 treated pigs but 3 died, the others remaining well and thrifty.

The heavy loss among the checks indicates that the disease was quite virulent, and the result of the treatment shows that in this instance at least the use of virulent blood in connection with the serum subsequent to exposure did no harm. Had the entire herd been treated the loss would in all probability have been very slight, and the experiment illustrates what can be done in many herds if the serum is used early.

HERD NO. 7.

Herd No. 7 was located in the northwest quarter of section 27, Grant Township, and was first seen on October 7, 1907. The herd was found in bad condition. A number of the shotes showed unmistakable symptoms of hog cholera; they were droopy, did not eat well, and a few had diarrhea. Some of the animals had been sick for three or four days before the herd was visited, and 2 had died only a few hours before. An examination of the dead animals revealed well-marked hog-cholera lesions—enlarged inguinal glands, engorged spleen, hemorrhages in kidneys, cecal ulceration, etc. The shotes all ran together and consequently all had been well exposed to the disease. The old sows, 14 in number, were kept in a separate lot and consequently were not so much exposed.

Twenty-nine pigs, many of them no doubt already slightly affected, were injected with 20 c. c. each of serum No. 2. Four apparently healthy pigs and 10 which showed signs of being indisposed were left as checks. Eleven of the old sows were given 30 c. c. each of serum No. 2, and the remaining 3 received the same dose of serum plus 1 c. c. of virulent blood. On October 23 these sows were turned into the lot with the sick shotes.

Of the treated pigs 12 survived and 17 died. Of the 14 checks 11 died and 3 survived, one of the latter being stunted in growth and worthless. All of the old sows survived without showing any indications of disease.

Although many of the treated pigs in this herd died, the result shows that even in a badly diseased herd the use of serum will save a certain percentage of the animals, probably enough to warrant its use.

HERD NO. 8.

Herd No. 8 was located in the southeast quarter of section 1, Grant Township. The owner had lost most of his hogs from hog cholera and desired to test the effect of the serum treatment by having some susceptible pigs treated with the serum and then placed on his supposedly infected premises. Accordingly he pur-

chased 12 shotes, weighing about 100 pounds each, from a healthy herd on an uninfected farm and 4 smaller pigs from another herd of the same description.

Eleven of the first lot of 12 were injected with 20 c. c. each of serum No. 2 plus 2 c. c. of virulent blood on October 8. The remaining pig of this lot and the 4 smaller ones of the other lot were left untreated as checks, and the entire lot was placed in the yards where disease had existed. A few shotes with lingering symptoms were still in the yards at the time.

As both the checks and treated pigs remained well, we must infer that the infection had died out on the farm before the experiment was begun. The experiment shows, however, that 2 c. c. of virulent blood may be given to 100-pound shotes in conjunction with 20 c. c. of serum without causing sickness.

Herd No. 9.

Herd No. 9, located in the northeast quarter of section 2, Union Township, Story County, probably became infected from Herd No. 5, situated about 20 rods distant. Other infected herds were near, however. When the herd was first seen on October 10, 1907, there had been no loss, but 2 shotes had been sick for two days with symptoms of hog cholera. The rest of the herd appeared healthy.

Thirty shotes, weighing about 100 pounds each, including the 2 sick ones, were injected with 20 c. c. each of serum No. 2 plus 1 c. c. of virulent blood. In view of the fact that disease had already appeared in the herd, the dose of virulent blood was reduced from 2 c. c. to 1 c. c. Five shotes of corresponding weight were left untreated as checks. Two old sows, weighing about 300 pounds each, received 40 c. c. of No. 2 serum plus 1 c. c. of virulent blood.

The result in this experiment agrees with that obtained in other herds where disease was just starting. The 2 pigs which were sick at the time of treatment succumbed, as did all of the checks. All of the others remained well and thrifty. As in the case of Herd No. 6, the use of virulent blood in a herd which had already had some natural exposure apparently did no harm. The high fatality among the checks goes to show that without treatment but a small part at best of the herd would have survived.

Herd No. 10.

Herd No. 10, located in the southwest quarter of section 6, Grant Township, was found in bad condition. The source of the disease could not be traced, as there were no infected herds near by. When the herd was first seen on October 12, 1907, 4 head had died and about half of the remainder showed indications of being more or

less affected. The sick animals remained in their nests, showed loss of appetite, were weak in the hind legs, and some had diarrhea. An autopsy on an old sow which had recently died revealed well-marked hog-cholera lesions, including hemorrhagic kidneys and ulcers in the cecum.

Fifteen shotes weighing about 150 pounds were given 30 c. c. each of mixed serum No. 2. Ten others of about the same size received the same dose of serum plus 1 c. c. of virulent blood. Three old sows weighing about 200 pounds each received 30 c. c. of serum alone, and 3 others weighing 400 pounds each received 40 c. c. of serum alone. The remainder of the herd, about 25 head, was left untreated.

Only one of the treated hogs died. This was an old sow which developed an extensive swelling at the point of injection, and there is a possibility that an infection at that point may have had something to do with the death. Of the 25 untreated checks 15 died—2 old sows and 13 shotes.

That this outbreak was not as virulent as some of the others described in this paper is shown by the number of checks which survived. The results, however, indicate that the serum possessed marked potency. Many of the treated shotes were apparently already slightly affected when injected, and the fact that they soon got better and recovered would tend to show a curative action on the part of the serum. A number of the surviving checks developed a lingering type of the disease and became stunted and of little value.

HERD NO. 11.

Herd No. 11 was located in the northeast quarter of section 36, Grant Township, in an infected neighborhood near Shipley. When first seen, on October 15, 1907, the herd was apparently unaffected, although hog cholera was within half a mile of the farm. Arrangements were made with the owner to administer the simultaneous treatment to the entire herd and later to expose one-half of the animals to hog cholera on an infected farm. While the herd was being treated one shote escaped and consequently was not treated. The remaining 35 head, weighing from 30 to 75 pounds, received 20 c. c. each of serum No. 2 plus 2 c. c. of virulent blood.

All continued well until the morning of the 24th, when 1 shote appeared droopy and refused to eat. At noon 2 others seemed droopy. When the herd was seen on the 25th 4 shotes were showing symptoms of cholera. On this date the entire herd was reinjected with 20 c. c. each of No. 3 serum. On the 26th 2 more were sick, and on the 28th 2 were dead and 7 sick. When seen on November 1, 5 had died and 3 of the sick ones seemed much better. One more died subsequently and 30 survived. Three or four of the latter were somewhat stunted as a result of the disease.

An autopsy on one of the shotes that died showed inguinal glands enlarged, spleen much enlarged and dark, a few small hemorrhages in the kidneys, mesenteric glands enlarged, and several small ulcers near ilio-cecal valve. There were also numerous hemorrhages in the lungs.

In this herd the result seems to indicate that it may be possible to start disease by the simultaneous treatment. As there can be no question about the potency of the serum used on this herd, we must regard the animals that sickened as having been unusually susceptible to disease, or else there was some unknown factor present. While the result in this herd points to the possibility of the disease having been started by the use of virulent blood in conjunction with the serum, it also indicates that if the disease is so started the loss will be comparatively slight if the herd is reinjected with serum alone. The owner expressed his belief that his loss was slight compared with what it would have been had the disease reached his herd in the natural way. In this statement he is undoubtedly correct, as in all cases where untreated herds in the neighborhood became affected the loss was very great.

Herd No. 12.

Herd No. 12 was located in the southeast quarter of section 26, Grant Township, in the infected territory around Shipley, and probably contracted the disease from a near-by infected herd. Two pigs sickened about October 12, 1907, and when the herd was seen and treated on October 15 these animals were decidedly sick and a few others were ailing. The sick animals appeared droopy, had poor appetites, and remained in their nests. The sicker of the two pigs was killed, and an examination showed hog-cholera lesions, including small hemorrhages in the lungs and kidneys and characteristic ulcers in the cecum and colon.

Sixty-two shotes weighing from 35 to 100 pounds were injected with No. 2 serum alone. Fifty-nine of the lot received 20 c. c. each, 1 received 30 c. c., and 2 received 10 c. c. each. Nine old sows weighing from 250 to 400 pounds received 40 c. c. each. Fifteen shotes of various sizes and 6 old sows were left untreated as checks.

The outbreak proved rather a mild one, as the checks did not die very rapidly. However, 8 of the checks died eventually, and also 13 of the treated shotes. The old hogs, both those treated and those untreated, remained well. It will be noted that over one-half of the check shotes died, while only a little more than one-fifth of the treated pigs succumbed.

Herd No. 13.

Herd No. 13, when first seen on October 15, 1907, was apparently well, but in danger of infection from Herd No. 12, located only about 20 rods distant. The experiment was as follows:

Five small pigs of 25 pounds received 10 c. c. each of No. 2 serum. Three shotes of 90 pounds each received 20 c. c. serum No. 2 plus 1

c. c. virulent blood. Five sows that had raised pigs and were consequently thin in flesh each received 30 c. c. of the same serum plus 2 c. c. of the same virulent blood. Two 90-pound shotes and 8 small pigs were left untreated as checks.

On October 26 the owner reported that 2 of the treated hogs showed loss of appetite. On the 28th one of these had apparently recovered, and the other also appeared much better, but a third animal did not seem altogether well. In order to prevent any further development of the disease, most of the checks and a part of the treated animals were given 20 c. c. each of serum No. 3 on October 28.

Only one animal died, and as opportunity for autopsy did not occur it is not possible to say whether or not hog cholera actually appeared in this herd. It is to be regretted that the distance of the herd from the station and the rush of work on other herds prevented more careful and extended observation during the three weeks following treatment. The experiment shows, however, that a healthy herd which was practically surrounded by infected herds was saved with the loss of but one animal.

Herd No. 14.

When treated on October 16, 1907, there was no indication of disease in Herd No. 14, although it was located in the southwest quarter of section 24, Grant Township, close to infected territory. The herd was small, consisting of but 27 very large spring shotes. Twenty head weighing from 125 to 170 pounds were given 20 c. c. each of serum No. 2 plus 2 c. c. of virulent blood. The remaining 7 shotes, which were of the same average size, were left as checks. The serum used in this experiment was the same as that used on Herd No. 11. The virulent blood was also the same except for the addition of blood from another sick pig.

The herd remained well until about November 20, when some of the check shotes showed loss of appetite. On November 26, 3 or 4 of the checks showed unmistakable hog-cholera symptoms. One of the treated shotes on this date appeared somewhat indisposed, but did not show any definite cholera symptoms. An examination of the herd on December 18 showed that 4 of the checks had died, 1 was very sick, and another was sick, but improving. The seventh check had been butchered by the owner for meat before disease appeared in the herd. Seven of the treated animals were marketed before the appearance of disease. The other 13 survived, and were in good condition when the herd was last inspected in December.

This is a most interesting experiment, as it shows that very large shotes were protected by the simultaneous treatment when only 20 c. c. of the serum was administered. It shows also that the use of viru-

lent blood did no harm, for the disease did not appear in this herd until more than a month after treatment. Had the entire herd been treated, we have every reason to believe that no loss would have occurred.

Herd No. 15.

When seen on October 16, 1907, Herd No. 15 showed no indication of disease, although located in section 3 of Union Township, near the town of Shipley and close to infected herds. It consisted mostly of small summer shotes. The experiment was carried out as follows:

Thirty-eight small shotes of about 30 pounds weight were given 10 c. c. each of No. 2 serum. Twelve larger animals of about 60 pounds weight received 20 c. c. each of the same serum. Seven old sows of 250 pounds were given 40 c. c. each of the same serum plus 2 c. c. of virulent blood. Two old sows and 11 shotes, some 30 and some 60 pounds in weight, were left untreated as checks.

As the checks did not later become sick, we must infer that this herd did not become exposed to hog cholera.

Herd No. 16.

When the experiment was started in Herd No. 16 on October 16, 1907, hog cholera existed in the neighborhood, but the appearance of the herd was good, indicating that exposure had probably not occurred. The herd was located in section 23 of Grant Township, and consisted of old sows and shotes of various ages.

Thirty-five shotes, whose average weight was about 80 pounds, were each injected with 20 c. c. of No. 2 serum plus 2 c. c. of virulent blood. The virulent blood was the same as that used on Herd No. 14. Seven shotes, weighing each 40 pounds, received 20 c. c. each of No. 2 serum, and 15 small shotes weighing 25 pounds each received 10 c. c. of the same serum. Three large spring shotes weighing 150 pounds and 13 old hogs weighing 300 to 450 pounds were treated with 40 c. c. each of serum plus 2 c. c. of virulent blood. Four old sows and 10 shotes of various sizes were left as checks.

The checks and treated hogs continued well until October 25, when some of the treated pigs seemed indisposed. When seen on the 28th one had just died and another was nearly dead. A post-mortem examination of these animals revealed the same pathological lesions in both. Engorgement of the spleen was the most marked lesion. One of the animals showed hemorrhages in the lungs and the other considerable edema of the lungs. Two or three others were found sick on the 28th. The sick and dead animals had all received the simultaneous treatment. The checks appeared well. By November 1, 5 of the treated animals had died and 2 more were sick, while the

checks appeared well. Subsequently 2 of the checks died, but in neither instance could an autopsy be performed.

The result in this herd shows that 5 of the treated animals died and 2 of the checks. If we attribute the disease to the simultaneous treatment it was sufficiently virulent to destroy but 2 of the checks, and the percentage of loss considering the total number of animals treated was very light.

Some time after the experiment was started it was learned that the owner had been feeding blue vitriol, but what effect, if any, this may have had on the result can not be determined.

Herd No. 17.

Herd No. 17 was located in the northeast quarter of section 3, Union Township, and was apparently well when treated on October 17, 1907, although hog cholera prevailed on near-by farms. Twenty-seven head averaging 100 pounds or more in weight were injected with 20 c. c. each of serum No. 2 plus 2 c. c. of virulent blood. Six shotes of the same weight were left as checks.

When the herd was inspected on October 28 one of the check shotes showed symptoms of hog cholera. This shote died a few days later, and other checks sickened. The sick animals showed the usual cholera symptoms. By November 26, 3 of the checks had died and at least 1 more was sick. When the herd was seen on December 19, 5 checks had died and the remaining one was sick.

This is a most interesting experiment, for it shows the application of simultaneous treatment to a healthy herd with subsequent exposure to disease resulting in the death of the checks, while the treated pigs showed no indications of disease, but continued well and thrifty.

Herd No. 18.

When treated on October 17, 1907, Herd No. 18 was apparently well, although located in the northeast quarter of section 3, Union Township, near infected farms. The herd was a mixed one, consisting of old sows, large spring shotes, small shotes, and sucking pigs.

Forty-four shotes weighing about 125 pounds received 30 c. c. each of No. 2 serum in conjunction with the usual dose of 2 c. c. of virulent blood. Six shotes, weighing 80 pounds, received 20 c. c. each of the same serum plus 2 c. c. of virulent blood. Two boars of 150 pounds weight each received 40 c. c. of the same serum plus 2 c. c. of virulent blood. Four pigs, weighing about 30 pounds, were given 10 c. c. each of serum No. 2 alone. Ten sucking pigs also received the same dose of serum No. 2 alone. Nineteen old hogs were given 40 c. c. each of the serum plus the usual dose of virulent blood. One

old sow, 12 shotes of various sizes, and a few sucking pigs were left untreated as checks.

The herd remained well for some time after treatment, and, in accordance with arrangements made with the owner, 3 of the checks and 11 of the larger treated shotes were moved to a near-by farm where hog cholera existed. These hogs were placed in a yard with sick shotes, with the result that 2 of the checks sickened and died and the third also sickened, but finally recovered. The 11 treated shotes remained well with the exception of 1 that died the day after it was moved. As this shote was perfectly well when placed in the sick herd, it must have died either from injuries received in fighting or from some cause other than cholera, as it certainly could not have contracted hog cholera and died within one day after exposure. An autopsy could not be held.

A short time after the removal of the shotes to the infected farm hog cholera appeared among those left, and 5 of the 10 remaining checks died. One of the 4 small pigs and 5 of the 10 sucking pigs also died. Of the untreated sucking pigs and some born since the herd was treated all died but 2.

It will be noted that of the pigs treated by the serum-simultaneous method only 1 died, and that from some cause other than cholera. Of the 12 untreated check shotes 7 died. The loss of 50 per cent of the sucking pigs is probably due to the fact that they received serum only and had lost at least a part of the transient immunity conferred by the serum before they became exposed to the disease.

Herd No. 19.

Herd No. 19, located in the southwest quarter of section 36, Milford Township, Story County, about three-fourths of a mile from Herd No. 10, was treated on October 18, 1907. The herd was well at this time, and the object in treating this and other herds in the same neighborhood was to prevent the spread of disease from Herd No. 10.

Eighteen shotes weighing about 125 pounds received 30 c. c. each of mixed serum No. 2 plus 2 c. c. of virulent blood. Sixteen shotes weighing from 60 to 90 pounds were given 20 c. c. each of the same serum plus the same dose of virulent blood.

All remained well, and as the entire herd was injected it can not be stated whether or not this herd became exposed. It is of interest, however, to note that no indication of disease followed the simultaneous injection of serum and virulent blood.

Herd No. 20.

When seen on October 18, 1907, Herd No. 20 did not look very thrifty, but showed no positive indications of disease. It was composed mainly of purebred Chester White hogs and was located in the

northeast quarter of section 20, Richland Township, Story County, at a considerable distance from any of the herds previously described, but near an infected herd in the same neighborhood. Treatment was carried out as follows:

Twelve old hogs of medium size were injected with 40 c. c. each of No. 2 serum plus 2 c. c. of virulent blood. Fifteen shotes weighing from 50 to 120 pounds received 30 c. c. each of the same serum plus 2 c. c. of the same virulent blood. Four small shotes weighing on an average about 20 pounds were given 20 c. c. each of serum alone. Ten sucking pigs each received 10 c. c. of the same serum. Two old sows, 2 shotes weighing 100 pounds each, and 6 sucking pigs were left as checks.

The herd continued well until about November 10, when the checks began to show indications of disease. All of the untreated animals died eventually except 1 of the 100-pound shotes, which did not contract disease. They showed the usual symptoms seen in hog cholera, but owing to the distance from the station no autopsies could be made.

None of the old treated hogs sickened, but of the 15 shotes injected with 30 c. c. each of serum and 2 c. c. of virulent blood, 3 died and 5 others became sick but recovered. The owner, however, states that in his opinion these 8 hogs did not show cholera symptoms, and as no post-mortem examinations were held it can not be stated whether they died as a result of hog cholera or from some other affection. Of the 14 small shotes and pigs injected with serum alone, all died but 1. It would seem probable that the serum-treated pigs had lost their transient immunity before exposure came. The fact that both of the old untreated check animals contracted disease and died, while the old hogs which were treated did not sicken, indicated that the animals which received the simultaneous treatment had not lost the immunity acquired by treatment. As the herd was not in a very thrifty condition at the time of treatment, it seems reasonable to suppose that some loss occurred in this herd from causes other than hog cholera.

Herd No. 21.

Herd No. 21 was located in an infected neighborhood in the northeast quarter of section 25, Milford Township. On October 18, 1907, the day of treatment, the herd seemed well with the exception of two or three pigs which appeared to have some respiratory trouble, a condition usually termed "thumps" by swine breeders. As the owner had not been advised that his herd would be visited on that day, only a portion of the shotes and old hogs could be caught, consequently only a few head were treated. No. 2 serum was used on this herd.

Eleven spring shotes weighing about 125 pounds were each given 30 c. c. of the serum together with 2 c. c. of virulent blood. Nine shotes weighing from 50 to 100 pounds were each given 20 c. c. of the serum and 2 c. c. of virulent blood. One old sow weighing about 250 pounds was given 40 c. c. of the serum with 2 c. c. of virulent blood. There were about 50 animals not treated.

In about one week after treatment the old sow began to show symptoms of disease. At about the same time 2 of the injected shotes showed some diarrhea and loss of appetite. The sow died on the 28th and at autopsy showed some redness of the skin over the abdomen and neck, hemorrhages in the lungs and heart, spleen very large, dark, and soft, liver congested, kidneys swollen, with small hemorrhages, mucosa of cecum hemorrhagic, lymphatic glands generally enlarged and congested.

On the same date (October 28) the entire herd was injected with serum alone, 73 head being treated. The 2 sick shotes were given 60 c. c. each, and the others from 20 c. c. to 30 c. c. each. The 2 sick animals soon recovered and no more sickened.

The result would seem to indicate that the sickness of the old sow and the 2 shotes resulted from the simultaneous treatment, but the same virulent blood was used on Herd No. 20 without resulting sickness, and we must conclude either that the hogs in Herd No. 21 were much more susceptible to hog cholera or else that some other factor was present. It is very interesting to note that the second treatment with serum alone prevented any further loss and even saved those that were sick. As the herd was a large one and contained over 50 check animals, the arrest and prevention of the further spread of the disease is more striking than in the case of a small herd containing only a few animals.

HERD No. 22.

Herd No. 22 was located near the Bureau station and within a quarter of a mile of diseased herd No. 10. When first visited on October 19, 1907, the herd seemed well, with the exception of 1 shote weighing about 60 pounds, and possibly a few of the sucking pigs. The sick shote showed loss of appetite, looked gaunt, and had some respiratory trouble. With a view of preventing the spread of disease to other farms the entire herd was treated. The herd contained old hogs, spring pigs, and also summer and fall pigs. No. 2 serum was used on this herd.

Eight old hogs were each given 40 c. c. of the serum plus 2 c. c. of blood from diseased animals. Twelve shotes of about 125 pounds received 30 c. c. each of the serum plus 2 c. c. of the blood. Thirty-three shotes of about 100 pounds received 20 c. c. each of the serum with 2 c. c. of the blood. Seven small shotes of 30 pounds were each

given 20 c. c. of the serum and 1 c. c. of blood. Thirteen small sucking pigs each received 10 c. c. of serum alone.

Within two or three days after treatment some of the sucking pigs began to show unthriftiness, loss of appetite, etc. Several of the smaller ones eventually died, and an autopsy on one showed hog-cholera lesions, the hemorrhages in the kidneys being quite prominent. The shote that was sick when treated also died, and another developed much swelling of the abdomen and finally died. The rest of the herd suffered with a more or less troublesome cough, but otherwise remained well.

The fact that some of the young pigs became sick within two or three days after treatment would indicate that hog cholera was just appearing in the herd at the time of treatment and was cut short by the injection of serum.

The blood used on this herd, as also on herds Nos. 23, 24, 26, and several others, was obtained from three sick shotes in herd No. 10. At the time the latter herd was treated the station force was treating other herds almost daily, and the supply of virulent blood for simultaneous treatment had begun to run low. It was thought, therefore, that virulent blood could be obtained from Herd No. 10, and accordingly blood was drawn from three sick hogs as stated above. The autopsy findings on the animals which furnished the blood showed characteristic hog-cholera lesions. When used on check shotes at the station, however, this blood was found to be lacking in virulence, but before its action on checks had been learned it was used, for the reason stated above, in the treatment of several herds. The low virulence of this blood had probably little effect on the results obtained in those herds where it was used.

HERD NO. 23.

Herd No. 23 was located in the northwest quarter of section 32, Milford Township, within 40 rods of a herd supposed to have cholera, and was first seen on October 21, 1907. At this time one shote was ailing, but not sufficiently sick to warrant its being killed for autopsy. The rest of the herd seemed well.

One old sow was given 40 c. c. of serum No. 3 plus 2 c. c. of the blood mentioned in connection with herd No. 22. Thirty-eight shotes of from 50 to 100 pounds were each given 20 c. c. of the same serum plus 2 c. c. of the same blood. One small pig was given 10 c. c. of serum alone. Five shotes of the same average size as the treated shotes and the sick shote were left as checks.

The sick shote grew worse and was killed for post-mortem examination. The autopsy, however, did not show hog-cholera lesions. The only lesions of importance were found in the chest cavity, and

consisted of edema and hepatization of the lungs. As there was no further loss among either the checks or the treated animals, it would seem probable that this herd was not exposed to hog cholera.

Herd No. 24.

Herd No. 24 was located about 30 rods from Herd No. 23. When first visited, on October 21, 1907, it was found to contain several unthrifty pigs, some of which were evidently suffering from a respiratory trouble. The larger shotes seemed well. A post-mortem examination of one of the unthrifty pigs failed to show hog-cholera lesions. No. 3 serum was used on this herd.

Sixty-two shotes of from 40 to 90 pounds in weight were each treated with 20 c. c. of the serum plus 1 c. c. of virulent blood. Eight small pigs received 20 c. c. each of the serum alone. Thirteen shotes of various sizes were left as checks.

As neither the checks nor the treated pigs became sick, we must conclude that this herd was probably not exposed to hog cholera.

Herd No. 25.

Herd No. 25 was located about 40 rods from Herd No. 23, and was treated on the same date. The herd was apparently affected at this time, as some of the animals had diarrhea and were not eating well. None were sufficiently sick, however, for autopsy.

Seven shotes of about 100 pounds weight were given 20 c. c. each of No. 3 serum. Fourteen others of about the same weight, including the sick ones, were left untreated as checks.

The fact that the sick shotes recovered and no others in the herd sickened would indicate that the trouble in this instance was not hog cholera.

Herd No. 26.

Herd No. 26 was located in the southeast quarter of section 36, Franklin Township, Story County, and was treated on October 21, 1907, with a view to preventing the extension of disease from herd No. 10, located 1 mile distant. The herd was apparently well when treated.

Fifty-eight shotes weighing from 35 to 100 pounds were each injected with 20 c. c. of No. 2 serum plus 1 c. c. of the blood mentioned in connection with Herd No. 22. As the object of the treatment was to prevent the spread of hog cholera in the neighborhood, all of the animals were treated and none were left as checks.

As no loss occurred in this herd and there were no checks it is impossible to say definitely whether of not the herd was ever exposed to hog cholera.

HERD No. 27.

Herd No. 27 was located between herds Nos. 10 and 26 and was in excellent condition when treated on October 21, 1907. Like the preceding herd, it was treated in order to prevent the spread of hog cholera in the neighborhood. All of the animals therefore were treated and no checks were left.

Twelve shotes of about 90 pounds in weight were each given 20 c. c. of No. 2 serum with 1 c. c. of the same blood as was used on herd No. 22. Two old sows were each given 40 c. c. of the serum plus 2 c. c. of the same blood. The entire herd remained well, and consequently it is impossible to say whether or not this herd was ever exposed to hog cholera.

HERD No. 28.

Herd No. 28 was located in a different neighborhood from the preceding herds, in the southeast quarter of section 19, Washington Township, Story County. It consisted of purebred Duroc-Jersey hogs of different ages. When first seen on October 22, 1907, all of the animals appeared well except three 100-pound shotes which had been a little droopy for three or four days. A neighbor living a quarter of a mile distant had been losing hogs for some time, probably from hog cholera. As herd No. 28 consisted of purebred animals, the owner had been feeding them high with a view to hastening their growth, consequently a majority of the animals, especially the young gilts, were unusually fat. The three sick shotes had been running with the gilts and old sows, so the entire herd had been more or less exposed to the sick hogs. The young boars had been kept in a separate yard and had been less exposed than the others. As the three sick shotes were of considerable value and not sick enough to warrant being killed, no autopsies were made at this time. No. 2 serum was used on this herd.

Twenty-nine spring gilts weighing about 200 pounds were each given 30 c. c. of the serum plus 1 c. c. of virulent blood. Four smaller gilts of about 100 pounds weight received 20 c. c. each of the serum and 1 c. c. of virulent blood. Twenty-one old sows were each given 40 c. c. of the serum with 1 c. c. of virulent blood. Sixteen young boars weighing from 100 to 150 pounds received from 20 c. c. to 30 c. c. each of the serum, in accordance with their weight, plus 1 c. c. of virulent blood. Two old boars were each given 40 c. c. of the serum plus 1 c. c. of virulent blood. Ten small sucking pigs were each injected with 20 c. c. of the serum. Three gilts were left untreated to be exposed later along with some of the treated animals in case the herd proved not to have been affected with hog cholera at the time of treatment.

When the herd was next visited, on October 31, a number of the gilts, including the three checks, were sick. One old sow had died very soon after treatment, but in the opinion of the owner did not show hog-cholera symptoms. She swelled badly under the abdomen, probably from infection at the point of inoculation. A post-mortem examination of one of the sucking pigs showed some redness of the skin, inguinal glands enlarged, spleen enlarged and dark, liver congested, and a few pin-point hemorrhages in the kidneys. By November 7 nearly all of the sucking pigs, several of the gilts, and one young boar had died. A few others were sick.

On November 24 a post-mortem examination was made of two of the treated gilts which had just died. Both showed similar lesions of the type usually seen in acute hog cholera—lungs engorged with blood, spleen enlarged and dark, liver much congested, well-marked hemorrhages in the kidneys, and many small ulcers in the cecum. Later inspection of the herd showed that 16 gilts, 3 old sows, 3 boars, 9 of the sucking pigs, and 2 of the checks had died. The third check became sick but recovered.

As most of the animals that died became sick very soon after treatment, it seems evident that exposure had occurred prior to treatment and that they were well advanced in the period of incubation when treated. In the case of the young boars kept in a different yard, where the chances were not so great for exposure before treatment, it will be noted that the loss was light. It should also be noted in the case of the gilts, where the loss was heaviest, that owing to their excessive fatness these animals were probably more susceptible to a fatal attack than if they had been in thinner flesh.

In considering the final results for the entire herd we must conclude that the treatment saved the owner a considerable number of animals which would otherwise have died and that earlier treatment would probably have saved a much larger percentage.

Herd No. 29.

Herd No. 29 consisted of purebred Chester White hogs of different ages, and was located in the northwest quarter of section 2, Jackson Township, Boone County, at some distance from the other treated herds. The source of the disease which affected the herd could not be traced, but it probably came from an infected herd in the neighborhood. When the herd was seen on October 22, 1907, several shotes had been sick for some days. The disease first appeared among the young gilts and barrows. The boars, which had been kept in a separate lot, were apparently well on the day of treatment.

The sick animals showed the usual hog-cholera symptoms—they remained in their nests, did not eat, became weak in the hind legs, and some showed diarrhea. A shote was killed for the purpose of making

a diagnosis, and the autopsy revealed hog-cholera lesions, but they were not altogether characteristic. There were some hemorrhages in the lungs, some enlargement of the spleen, slight congestion of the liver and kidneys, and a few small ulcers in the cecum. A post-mortem examination of a 100-pound shote, that died on October 31, showed similar lesions, except that the liver was greatly congested and there were well-marked ulcers in the cecum and intestines.

The herd was treated on October 22 with No. 3 serum. Fifteen young boars weighing about 100 pounds were each given 20 c. c. of the serum plus 1 c. c. of blood from diseased animals. Seven yearling boars received 40 c. c. each of the serum plus 1 c. c. of the same blood. One yearling sow received the same treatment as the yearling boars. Thirty shotes of various sizes, from 50 to 100 pounds in weight, each received 20 c. c. of the serum alone. Five boars, 1 old sow, and 8 shotes were left untreated as checks.

When the herd was inspected on October 31 it was found that most of the 8 check shotes were sick, and also 2 or 3 of the treated pigs. No appearance of disease could be noted among the boars on this date. On November 7 the boars were still well, but soon after this date the owner castrated a number of them, including both checks and treated pigs. Soon after being castrated the checks sickened, and also some of the treated boars. Eventually all of the check boars died, and also 1 of the treated boars. The old sow, which was left as a check, died after a lingering illness, and all of the 8 check shotes died except 1. Of the 30 shotes treated with serum alone only 4 died.

It should be noted that the blood used in the treatment of the boars was the same as that used on Herd No. 28, and did not possess a high degree of virulence. As the disease did not appear among the boars until some time after treatment, it is possible that the serum-treated hogs had lost some of the immunity induced by the serum. However, as but one treated boar succumbed, and the checks all died, the treated animals evidently retained sufficient immunity to protect them, save in the one instance. It seems very probable that had the whole herd been treated the loss would have been very light.

The result obtained in this instance with mixed serum No. 3 coincides with that obtained in other herds treated with other mixed serums. The owner was greatly pleased with the result, and later held a sale of purebred animals.

Herd No. 30.

Herd No. 30 was treated on October 23, 1907, with a view to preventing the spread of cholera from Herd No. 10, situated but a quarter of a mile distant. The animals were apparently in good health and the entire herd was treated.

Thirty-seven shotes weighing from 50 to 125 pounds were given 20 to 25 c. c. each of serum No. 3 plus 2 c. c. of blood from diseased animals. One old sow received 40 c. c. of serum alone.

In view of the fact that all of the animals remained well and that the entire herd was treated, it is impossible to say whether or not this herd was ever exposed. The blood used on this herd did not prove very virulent when tested at the station.

Herd No. 31.

Herd No. 31 was located in a cholera district in the northwest quarter of section 22, Grant Township, and had been in considerable danger for some time on account of the close proximity of infected herds. The herd was treated on October 23, 1907, at which time all of the hogs seemed well save one old sow. This animal showed some diarrhea, which the owner attributed to the fact that she had been fed with pumpkins. No. 3 serum was used on this herd.

Twenty-five shotes weighing from 60 to 100 pounds were each given 20 c. c. of the serum plus 2 c. c. of blood from diseased animals. Seven old hogs weighing from 250 to 350 pounds were given 40 c. c. each of the serum and 2 c. c. of the blood. Twelve sucking pigs received 10 c. c. each of the serum alone. Four shotes of various sizes, 1 old sow, and 4 sucking pigs from the same litter as those treated were left as checks.

The old sow that was held as check died two days after the herd was treated. One of the treated shotes also died four days after injection. On November 1, 3 of the checks and 1 treated shote were sick. Later the treated shote and 2 of the check shotes died. A final inspection of the herd showed that of the 4 check shotes 2 died and the other 2 became sick, but recovered. The 4 sucklings which were left as checks all died, while the treated sucklings all lived. The old sow which served as a check died, whereas all of the old hogs that were treated survived. Of the 25 treated shotes, only 2 died, the other 23 showing no indications of disease.

The history of this herd after treatment seems to show that exposure had occurred before the herd was treated and that serum was used just in time to save the herd. As the blood used was the same as that used on Herd No. 29 and was found to be not very virulent, the protection afforded by the simultaneous treatment was no doubt no greater than that which would have been afforded by serum alone. The result here coincides with that obtained in other places where herds were treated early.

Herd No. 32.

Herd No. 32 was also located in Grant Township, in the southeast quarter of section 18. The herd was first seen and treated on October

24, 1907, at which time it had evidently been exposed to hog cholera, as 2 shotes showed well-defined hog-cholera symptoms—loss of appetite and droopiness. The rest of the herd appeared to be well. No. 3 serum was used on this herd.

Fourteen shotes of about 150 pounds received each 30 c. c. of the serum plus 2 c. c. of virulent blood. Eight shotes of the same weight were each given 20 c. c. of the serum and 2 c. c. of the blood. Twenty-one shotes, including the 2 sick ones, ranging in weight from 40 to 100 pounds, each received 20 c. c. of the serum and 2 c. c. of the blood. Nine slightly smaller shotes were each given 20 c. c. of the serum with 1 c. c. of the blood. One old sow weighing 250 pounds was given 40 c. c. of serum and 2 c. c. of virulent blood. Fourteen shotes weighing from 40 to 150 pounds were left untreated as checks.

When seen on November 5 the 2 pigs that were sick when treated had died. The other treated pigs were all apparently well. One check had died and 12 others were sick. The checks continued to die until 11 of the 14 were lost. One of the 3 which survived became worthless from chronic cholera; the other 2 were in fairly good condition.

The result here is similar to that obtained in Herd No. 31. The disease had just started and was immediately checked by the use of serum.

Herd No. 33.

Herd No. 33 was located about a quarter of a mile from Herd No. 10, and the entire herd was treated on October 25, 1907, in order to check the spread of disease in the neighborhood.

Seven spring shotes of 200 pounds in weight each received 40 c. c. of No. 3 serum, and 6 shotes of 120 pounds in weight were each given 30 c. c. of the same serum.

As the entire herd was treated, it is impossible to say whether or not this herd was exposed to hog cholera.

Herd No. 34.

Herd No. 34 was located in close proximity to Herd No. 10 and was treated with a view to preventing the spread of the disease. The entire herd was treated on October 25, 1907, as follows: Thirty-two shotes weighing from 60 to 110 pounds were given 20 c. c. each of No. 3 serum, and 8 old hogs weighing from 350 to 450 pounds received 40 c. c. each of the same serum.

This herd also remained well, and consequently it is not known whether or not the herd became exposed.

Herd No. 35.

In response to a very urgent request from the owner, Herd No. 35 was visited on November 6, 1907. It was located in Jackson Township, in the northeast quarter of section 34. It consisted of purebred

Duroc-Jersey hogs of different ages. One shote had died and several others were showing characteristic symptoms of hog cholera at the time of our visit. As the animals were all very valuable, none of the sick ones were killed for autopsy. Our supply of serum just at this time was unfortunately quite limited, so a considerable number were put aside as checks, consisting of barrows and smaller gilts.

Treatment was carried out as follows: A boar weighing about 200 pounds, that had already showed symptoms of cholera, was given 70 c. c. of No. 2 serum. Two boars weighing about 140 pounds each, both of which also showed symptoms of disease, were given 40 c. c. each of the same serum. Eleven boars weighing from 100 to 200 pounds each, all probably more or less affected, were given 30 c. c. each of the same serum. Two shotes, probably infected, received 40 c. c. each of No. 3 serum. Three shotes of about 50 pounds were given 20 c. c. each of No. 3 serum. Thirty-three shotes of different weights were given 30 c. c. each of No. 3 serum.

One old sow with young pigs was given 40 c. c. of No. 2 serum. Four of her pigs received 20 c. c. each of the same serum, and 3 others of the litter were left untreated as checks. Another old sow and litter were also left as checks, except that 7 of her pigs received 20 c. c. each of No. 2 serum. Both litters were about 2 months old. Five old sows received 50 c. c. of serum No. 3 alone. Twenty-seven shotes of various sizes, from 100 to 150 pounds in weight, were left untreated as checks.

The treatment of this herd shows some interesting results. Of the 14 boars which were treated only 2 died. The one given 70 c. c. of serum showed improvement for two days after treatment and then became worse and finally died. It is possible that a second injection with serum might have saved this animal. Several of the treated boars showed slight symptoms of disease but recovered. Of the 38 treated shotes only 3 died, and most of the others showed no indication of disease. The old sow which served as a check died, while the old sows which were treated remained well. All of the treated sucking pigs in both litters remained well, while all of the checks in both litters died. Of the 27 untreated shotes which were left as checks all died but 5.

It will be noted that in this herd the disease was sufficiently virulent to kill all classes of animals not protected by serum. Furthermore, in the case of the boars which had been more exposed to disease than the other animals before treatment, it will be noted that the disease was not entirely prevented, but so modified that most of these animals recovered. In the two young litters the result is very striking and shows that young pigs can be protected if the dose of serum given is sufficiently large.

HERD NO. 36.

Herd No. 36 was located in the northeast quarter of section 8, Grant Township, and when first seen on November 6, 1907, was thought to be infected with hog cholera, as an old sow in the herd showed symptoms of the disease. As the probabilities were that disease already existed in this herd, serum No. 3 alone was used.

Four old sows were each given 40 c. c. of the serum; 7 young boars of about 150 pounds weight were each given 30 c. c.; 25 shotes of various weights received 20 c. c. each; and 3 shotes of larger size were given 30 c. c. each. The old sow which was sick and a number of shotes of various sizes were left as checks. The sick sow recovered, and no further trouble occurred in the herd.

In connection with this herd it is of interest to note that the gilts were sold at public sale in March, 1908, and that some of them were bought by a man who had hog cholera on his farm. These animals contracted the disease and died after being put in the infected yards. This simply goes to show, however, that they were not made permanently immune by the injection of serum alone, the simultaneous method not being used in this herd.

HERD NO. 37.

Herd No. 37 was located in section 21, Washington Township, within half a mile of an infected herd, but was apparently well when treated on November 7, 1907. The herd consisted of purebred Berkshire hogs of various ages. No. 3 serum was used on this herd.

Twelve shotes weighing from 125 to 200 pounds were each given 30 c. c. of serum plus 1 c. c. of virulent blood. One shote of slightly heavier weight received 40 c. c. of serum plus 1 c. c. of virulent blood. One shote of 100 pounds was given 20 c. c. of serum plus 1 c. c. of virulent blood. Three fall pigs weighing about 25 pounds were given 20 c. c. each of serum alone. Five small sucking pigs received 10 c. c. each of serum alone. One old boar was given 60 c. c. of serum plus 1 c. c. of virulent blood. Two old sows received 50 c. c. each of serum plus 1 c. c. of virulent blood. Four old sows received 40 c. c. each of serum plus 1 c. c. of virulent blood.

Two shotes weighing about 150 pounds each were left untreated as checks for later exposure with a part of the treated animals, but owing to the lateness of the season and the absence of disease in the neighborhood the plan of exposing a part of the herd by placing them with hogs sick with hog cholera could not be carried out. As the check shotes did not contract disease, we must conclude that the herd did not become exposed to hog cholera. It is of interest to note that the use of 1 c. c. of virulent blood in conjunction with the serum caused no symptoms of disease.

Herd No. 38.

Herd No. 38, located in the southwest quarter of section 26, Franklin Township, was apparently well when treated on November 9, 1907. The herd was a purebred one of the Duroc-Jersey breed and consisted of old hogs and spring shotes of various sizes.

Thirty-one spring gilts weighing from 100 to 200 pounds were each injected with from 30 to 40 c. c. of No. 2 serum, according to the size of the animal, together with 1 c. c. of virulent blood. Sixteen spring boars of about the same weight as the gilts were given the same dose of serum and virulent blood. One old boar was given 50 c. c. of the same serum plus 1 c. c. of virulent blood. Sixteen old sows, weighing from 300 to 400 pounds each, were given the same treatment as the old boar. Thirteen barrows (spring shotes) were left untreated as checks.

The herd continued well until December 2, when one of the untreated shotes was noticed to be a little off feed. About eight days prior to this date a young boar that had had a light attack of hog cholera but had apparently entirely recovered was brought from herd No. 35 and placed with herd No. 38. Before being placed with herd No. 38 this animal had been thoroughly washed with a solution of one of the ordinary coal-tar disinfectants. The untreated shotes ran with the treated gilts in a yard adjoining that in which the boar from herd No. 35 was kept, and undoubtedly contracted disease from him.

The check shote which showed loss of appetite on December 2 grew worse and died on December 7, the autopsy revealing the usual lesions of hog cholera, such as engorged spleen, hemorrhages in the kidneys, etc. On this date another check was observed with symptoms of hog cholera. Some days later 2 more of the checks sickened, and the owner, fearing that all of the untreated animals would eventually die, sold for immediate slaughter those checks which had so far remained well. The 3 sick checks which were not sold all died eventually. None of the 35 or more treated shotes which were in the same inclosure with the checks showed any indications of disease.

On December 4 the owner sold at public sale a draft of breeding animals from the herd, advertising them as " vaccinated " and guaranteeing them to be cholera-proof for a period of two months. Several of these animals were bought by farmers who had recently lost hogs from hog cholera and some of them were undoubtedly placed on infected premises, but in not a single instance was it afterwards shown that any of them contracted the disease.

The result with this herd shows that all of the treated animals were made immune by the simultaneous injection of serum and virulent blood. The transfer of the young hog from Herd No. 35 shows the danger that may result from placing with a susceptible herd an animal which had apparently entirely recovered from hog cholera.

HERD NO. 39.

Herd No. 39 was located in the northeast quarter of section 12, Jackson Township. Two old sows and several shotes were quite sick when the herd was first seen on November 13, 1907. One of the sick shotes was killed, and a post-mortem examination showed the lesions of hog cholera, but not as marked as usually seen in acute cases of the disease. The entire herd, with the exception of 5 male shotes confined in the hog house, had been exposed to the disease through contact with the sick animals. No. 4 serum was used on this herd.

Twenty-eight shotes, weighing from 100 to 150 pounds, that had been exposed to infection through contact with the sick animals were each given from 40 c. c. to 50 c. c. of serum. One sick shote was given 80 c. c. of the serum. Five boars weighing about 175 pounds were each given 50 c. c. of serum; these animals had not been exposed to infection. One old sow, sick at time of treatment, received 100 c. c. of serum. Ten shotes of different sizes were left untreated as checks. One old sow which was sick was not treated.

Later inspection of the herd showed that 3 of the treated animals, including the sick shote injected with 80 c. c. of serum, had died. The other treated animals all survived in good condition. All of the checks finally succumbed except 2. One of these did not become sick, and the other became sick and recovered but was stunted and worthless.

The infection in this herd was evidently not very acute, as the checks showed a lingering type of the disease. In view of the fact, however, that all but two of the checks succumbed, it is reasonable to suppose that the fatality in this herd would have been much greater had the serum not been used.

HERD NO. 40.

Herd No. 40, located near Herd No. 39, in the southwest quarter of section 7, Washington Township, was treated November 13, 1907. Hog cholera had prevailed in this herd for about two weeks before the herd was visited. Several hogs had died and a number of others were sick at the time of treatment. One of the sick animals was killed and a post-mortem examination showed lesions of subacute hog cholera.

Sixteen shotes weighing about 100 pounds each, all of which had been exposed and some of which were probably more or less affected, were given 40 c. c. each of No. 4 serum. Two shotes that were unmistakably sick received 50 c. c. and 60 c. c., respectively, of the same serum. Seven shotes, all of which had been exposed and 2 of which were sick, were left as checks.

The 2 sick checks and the 2 treated animals which were sick died, the others survived. The fact that only 2 of the untreated checks

died would indicate that the disease in this instance was not very virulent.

Herd No. 41.

Herd No. 41 was located in the southwest quarter of section 17, Grant Township. In the opinion of the owner the animals had not been well for several days. They showed loss of appetite, and several presented a somewhat gaunt appearance, but none were sufficiently sick to warrant being killed for post-mortem examination. Serum No. 4 alone was used, as indicated below, on November 15, 1907.

Fifty spring shotes weighing from 125 to 200 pounds were given 40 c. c. each. One shote was given 20 c. c.; 1 received 15 c. c., and 53 were left untreated as checks.

As neither the checks nor the treated animals sickened, it is probable that the herd did not become exposed, or else the infection was a very mild one.

Herd No. 42.

Herd No. 42 consisted of purebred Chester White hogs and was located in an uninfected neighborhood, section 21, Franklin Township. The herd consisted of old sows, young spring gilts, young boars, and fall pigs. Disease was communicated to the herd by a breeding animal brought from a purebred herd in another part of the State. When treated on November 19, 1 boar had died, 2 others showed symptoms of hog cholera, and others had doubtless been exposed. From the symptoms a diagnosis of hog cholera was made and the herd was treated with No. 4 serum alone.

Two young boars weighing about 175 pounds were given 50 c. c. each. One old boar weighing about 700 pounds was given 60 c. c. Seventeen yearling sows weighing from 300 to 500 pounds received 60 c. c. each. One old sow of lighter weight was given 50 c. c. Thirty-six spring gilts of about 200 pounds in weight received 50 c. c. each. Twenty fall pigs of from 25 pounds to 30 pounds in weight were given 20 c. c. each. Six spring boars weighing about 175 pounds each, 1 old sow, 4 spring gilts weighing 200 pounds each, and 30 fall pigs were left untreated as checks.

Four of the treated gilts died and 2 others became sick, but recovered. Of the 20 fall pigs that were treated 3 died. The other treated animals remained well and in good condition. This result was very pleasing to the owner, who was very anxious to have his herd treated with the serum. Of the checks all of the 30 fall pigs died, as did 4 of the 6 boars, the old sow, and 2 of the 4 gilts. The other 2 gilts sickened, but recovered. It seems very probable that had the entire herd been treated the loss would have been very slight.

HERD NO. 43.

Herd No. 43 probably became infected from Herd No. 32, located but a short distance away. The herd was first seen on November 23, 1907, at which time there were 3 sick shotes. The sickest animal was killed, and a post-mortem examination showed hog-cholera lesions, consisting of enlarged lympathic glands and hemorrhages in the lungs and kidneys. As infection was already present, the herd was treated with serum alone, No. 4 serum being used.

Four old sows were given 60 c. c. each. Twenty-four gilts, weighing about 125 pounds, and 8 barrows of the same weight, received 40 c. c. each. Five fall pigs received 30 c. c. each. Fifteen pigs of different weights were left as checks.

The results correspond with those obtained in other herds where disease had just appeared. Of the 41 treated animals only 3 died. Of the checks 4 died within a short time after treatment, and the owner, fearing he would lose the remainder, sold 11 to shippers, some of the animals being off feed at the time. Had these check animals not been disposed of they would probably all have died of hog cholera.

HERD NO. 44.

Herd No. 44 was located near herd No. 32, and was in very bad condition when first seen on November 29, 1907. The herd was so badly infected that it hardly seemed worth while to use the serum, but the owner was very anxious that some of his animals be saved if possible, so a considerable part of the herd was treated. The symptoms exhibited by the sick animals were unmistakably those of hog cholera. Serum No. 5 was used on this herd.

Seventeen shotes of various sizes, a number of them visibly sick, were each given from 20 to 60 c. c. of the serum. Fourteen small pigs, probably all more or less affected, received 10 c. c. each. Two shotes and 5 small pigs were left untreated as checks.

Later examination of the herd showed that 12 of the treated shotes and 1 of the checks survived. All of the small pigs, both treated and untreated, died.

From the virulence of the disease it seems very probable that more of the shotes would have succumbed had they not been treated. This herd, however, was too badly infected at the time of treatment to expect very favorable results from the serum. Most of the animals were probably in the later stages of the period of incubation before the serum was administered.

HERD NO. 45.

Herd No. 45 was located near the northwest suburbs of Nevada, Iowa, in a neighborhood where hog cholera had been raging for some time. When the herd was first seen on November 30, 1907,

symptoms of the disease had prevailed for several days. Four animals had died and several showed well-marked symptoms of hog cholera. An autopsy on an animal which had recently died revealed the usual hog-cholera lesions. This herd, like Herd No. 44, was not considered favorable for an experiment, but it was deemed advisable to inject some of the animals with serum alone, as the owner was very anxious to have the serum used on his herd.

Twenty-nine shotes of various sizes were given 40 c. c. each of No. 5 serum, and 3 old hogs received 80 c. c. each of the same serum. Thirteen shotes of different sizes were left untreated as checks.

A subsequent inspection of the herd showed that of the 29 treated shotes 3 had died, whereas of the 13 checks 5 had died. The 3 old hogs remained well.

The result would indicate that a considerable proportion of the treated animals were saved by the serum treatment.

Herd No. 46.

Herd No. 46 was located near Herd No. 40, but did not become infected until late in the season. When first seen on December 31, 1907, several of the animals had died and a considerable number were showing well-marked symptoms of hog cholera. One of the sick animals was killed for autopsy and the usual hog-cholera lesions were noted. The majority of the herd followed fattening cattle, and were in excellent condition when the disease appeared. No. 5 serum was used on this herd.

Fifty-five shotes that had been kept in the same yard with the sick animals were given 40 c. c. each of the serum. A number of the animals in this lot were no doubt already somewhat affected at the time of treatment. Fifteen shotes of larger size, weighing about 250 pounds and kept in an adjoining lot, received from 30 to 50 c. c. each. Four old hogs received the same dose as the last. Ten shotes of different sizes, of approximately the same weights as the treated animals, were left as checks.

The result was very pleasing to the owner. Of the 70 shotes that were treated only 9 died, whereas of the 10 checks 7 died. Had the herd not been treated it is likely that only a few would have survived.

Herd No. 47.

Herd No. 47 was examined and treated on January 10, 1908. It was located close to Herd No. 43 and probably became infected by the extension of disease from that herd. Some time during the fall of 1907 the owner had procured from Chicago a supply of a commercial vaccine with the intention of using it if his hogs became sick. When his herd became infected early in January he wished to have the

Bureau serum used on a part of the herd in comparison with the commercial serum, in which he apparently had no great faith. Serum No. 5 was used on this herd.

Seven old hogs were given 40 c. c. each of the serum. Nine spring gilts received 30 c. c. each and 1 boar was given 40 c. c. On the same day the owner vaccinated 31 spring shotes of various sizes with the commercial preparation.

In the lot treated with the Bureau vaccine no deaths resulted, whereas of the 31 treated with the commercial preparation only 6 survived.

DISCUSSION OF RESULTS.

Much definite and valuable information was gained in regard to what may be accomplished by the use of hyperimmune serum in herds in which hog cholera has already appeared. It was stated in Bulletin 102—and later experiments have confirmed the statement—that hogs treated with hyperimmune serum are protected against hog cholera if they are at once exposed to the disease either by the simultaneous injection of the usual fatal dose of disease-producing blood or by association with animals sick of the disease. It was also shown that the immunity produced by the use of serum alone is a transient one, lasting as a rule for only a few weeks, unless it is rendered permanent by exposure soon after vaccination. Repeated experiments have shown that if exposure occurs soon after vaccination the period of immunity is lengthened to at least six months and probably lasts during the life of the animal. The result is the same whether the exposure to the disease is brought about through association with sick hogs or by the injection of disease-producing blood, as in the simultaneous method.

Bearing the above-mentioned facts in mind, it will be seen that in applying the serum treatment serum alone should be used in the case of herds already affected with hog cholera, the injection of the serum and the subsequent exposure to the disease being all that is needed to insure a lasting immunity. In case, however, the herd is so divided that some of the animals may escape exposure and there is danger that the transient immunity conferred by the serum may be lost, it then becomes necessary to use the simultaneous method, which insures exposure and confers a more lasting immunity.

A large number of herds were treated in which hog cholera had recently appeared. Some of these herds were treated by the serum method and others by the simultaneous method.

SERUM TREATMENT OF RECENTLY INFECTED HERDS.

A study of the herd records shows that a considerable number were injected with hyperimmune serum alone. As examples of those in which hog cholera was just starting and which were treated in

this way may be mentioned, among others, Herds Nos. 5, 12, 42, and 43. In these four herds 233 hogs were treated and 104 were left untreated.[a] Of those treated 25, or less than 11 per cent, died, while of the 104 untreated checks 79, or 76 per cent, succumbed.

In all of the herds mentioned above the sick animals ran with the rest of the herd and no attempt was made to separate the sick from the healthy animals. The results were similar to those obtained in the special experiments previously carried out at the Bureau station and described in Bulletin 102; that is to say, those animals not already affected and those in the early stages of the period of incubation remained well and thrifty while the check animals sickened and died.

SERUM TREATMENT OF BADLY INFECTED HERDS.

In the case of badly infected herds—that is, those containing a considerable number of sick animals, many of them in the last stages of the period of incubation—the results were not as good as in the recently infected herds. This of course was to be expected. Herds Nos. 7, 10, 29, 35, 39, 40, 44, 45, and 46 may be considered under this heading as herds in which the disease was already well established at the time of treatment. These herds, with the exception of a few animals, were treated with serum alone, for, as has been already stated, it is unnecessary to administer disease-producing blood in conjunction with the serum when the treated animals are sure of early subsequent exposure. In these herds 386 animals were treated, and of this number 63, or about 16.5 per cent, died, whereas out of 132 untreated checks, 94, or about 71 per cent, died.

In some of these herds the protection afforded by the serum to hogs of various ages was very striking. This is especially well shown in the case of Herd No. 35. It was also observed in many instances that the serum did not prevent the disease, but rendered it less severe, and recovery took place without permanent injury to the animal. In other words, what would have been an acute and probably fatal attack was changed to a comparatively mild one, ending in good recovery.

While it is best, therefore, to use the serum as soon as possible after the disease appears, its use is nevertheless warranted even after the herd has become badly infected and contains a number of sick animals.

SIMULTANEOUS TREATMENT OF HEALTHY HERDS.

In order to ascertain what may be accomplished by the treatment of herds in which the disease has not yet appeared—one of the questions upon which the field tests were expected to throw some light—

[a] The owner disposed of 11 untreated hogs in herd No. 43 before completion of the experiment. For this reason these are not included in the summary.

a number of herds, themselves free from disease, but located on the borders of infected neighborhoods, were treated by the simultaneous method. Some of these herds became exposed to hog cholera later on, as was shown by the death of the checks. As an example of herds so treated and which later became exposed to disease may be mentioned Nos. 14, 17, 18, 20, and 38. These herds were located in four different neighborhoods and the results were practically the same in each case. In these 5 herds 201 hogs that were treated by the simultaneous method remained under observation until the close of the experiments; of this number only 3, or about 1½ per cent, died, and it is not certain that these had hog cholera, as the owner of the herd to which they belonged stated that in his opinion they did not show hog-cholera symptoms. This herd being at some distance from the Bureau station, no post-mortem examinations could be made. In the same herds there were 38 untreated checks, and of this number 28, or about 74 per cent, died. Had all the animals in these 5 herds been treated, it seems reasonable to suppose that the loss would have been very slight.

In the case of Herds Nos. 22, 31, and 32 the disease-producing blood used in conjunction with the serum did not prove virulent on check animals, and we can not therefore be sure that this blood had any influence upon the production of immunity in these cases. In Herd No. 22 no check animals were used, but of the 60 treated hogs only 2 died. In Herds Nos. 31 and 32, 85 animals were treated, and only 4, or a little under 5 per cent, died, whereas of the 23 untreated checks 18, or 78 per cent, died.

SIMULTANEOUS TREATMENT OF RECENTLY INFECTED HERDS.

As it is sometimes impossible to make a positive diagnosis of hog cholera at the beginning of an outbreak, it may be difficult to decide whether the serum method or the simultaneous method should be employed. In this connection the question has arisen as to whether in the case of herds already affected the use of disease-producing blood is likely to lead to bad results. In order to throw some light on this point the simultaneous treatment was used on infected herds Nos. 4, 6, and 9. The result was apparently the same as in the herds treated with serum alone. In the three herds just mentioned the number of animals treated was 131, and of these, 7, or 5 per cent, died. Of the 18 untreated animals in the same herds 14, or 80 per cent, died.

The result obtained in infected herds where simultaneous treatment was employed confirms the results of some special experiments along the same line, and the evidence so far at hand indicates that at the beginning of a hog cholera outbreak either method of vaccination may be practiced with equally favorable results. In cases where the diagnosis is doubtful, the simultaneous method is preferable because of the more permanent immunity it confers.

SUMMARY OF ALL INFECTED HERDS TREATED BY THE SIMULTANEOUS METHOD.

As an indication of what may be accomplished by the simultaneous method in infected herds, there may be cited Herds Nos. 4, 6, 9, 10, 14, 17, 18, 20, 22, 28, 29, 31, 32, and 38. In some of these herds the disease was present at the time of treatment, and in others it appeared subsequent to the treatment. In these herds 539 animals were treated, of which 47, or 8.7 per cent, died. In the same herds there were 108 untreated animals, of which 79, or approximately 73 per cent, succumbed. Four or five of the checks became sick and recovered, but were stunted and worthless, and 9 were sold before disease appeared in the herd. It should be stated that all the loss that occurred among the treated hogs took place in herds where disease existed at the time of treatment.

It seems evident that the simultaneous treatment is indicated (1) when it is desired to immunize healthy hogs for a longer period than a few weeks, (2) in herds where infection is suspected but regarding which some doubt may exist, and (3) in infected herds where there is a probability that some of the animals may not become exposed and there is danger that the transient immunity which the serum alone imparts may be lost.

CAN DISEASE BE STARTED IN HEALTHY HERDS BY THE SIMULTANEOUS TREATMENT?

This question is an important one, and was given early consideration in the experimental work at the Bureau station. It was shown in Bulletin 102 that hogs are not injured by the simultaneous injections when a sufficient dose of serum is administered with the virulent blood. It was also shown that in those cases where the dose of serum was not sufficient to protect the treated animals completely, symptoms of disease developed more slowly, the disease was much milder in its course, and it was not communicated to other hogs unless the treated animals became quite sick.

As 20 c. c. of hyperimmune serum given simultaneously with 2 c. c. of virulent blood had proved satisfactory in the experimental tests for pigs weighing from 25 to 75 pounds, approximately the same amount of serum was used at the beginning of the field tests. In Herd No. 2 this dose was used for pigs weighing 75 pounds, and in Herd No. 4 the same dose was used for shotes weighing as much as 100 pounds. In both instances the animals were protected against the 2 c. c. of disease-producing blood. In the case of Herd No. 6, which received the simultaneous treatment, the herd also had some natural exposure to disease, but the serum protected against the 2 c. c. of virulent blood as well as against the natural exposure,

except in the case of 3 animals which were probably infected before treatment was carried out. In Herd No. 8, where the animals were given the same doses of serum and disease-producing blood, the simultaneous treatment also gave entirely satisfactory results.

In Herd No. 11, however, where the treated animals were not large and apparently not more susceptible to virulent hog cholera than usual, the simultaneous treatment was followed by the appearance of disease. Nine days after treatment 2 or 3 of the shotes became droopy and later died after exhibiting the usual hog-cholera symptoms. Autopsies on these animals showed the usual hog-cholera lesions. As the herd contained only 1 untreated pig, and this could not be identified, it could not be determined whether the disease in this instance was readily communicable to healthy shotes or not. As will be seen from the herd records, the loss in this herd was comparatively light. There can be no question as to the potency of serum No. 2, and the virulent blood was the same as that used in some of the other herds with satisfactory results. It would seem that the animals in Herd No. 11 were either unusually susceptible to disease or else some unknown factor was present which in some way influenced the results.

In Herd No. 14 very large shotes, weighing from 125 to 160 pounds, were treated by the simultaneous method with satisfactory results. In Herd No. 17 shotes weighing 100 pounds were also given the same treatment with no indication of trouble, but in Herd No. 16 much smaller shotes were apparently made sick by the simultaneous treatment. However, in this herd the loss was small considering the number of animals involved. In but one other herd did disease appear to have been started by the simultaneous treatment. This was No. 21, where an old hog became sick about one week after injection and soon died, an autopsy revealing hog-cholera lesions. Two shotes in this herd also seemed sick, but recovered after receiving an injection of serum. Many other herds received the simultaneous treatment, but showed no indication of disease as a result.

The prompt re-treatment of the three herds, Nos. 11, 16, and 21, with serum alone was sufficient to prevent serious loss. In Herd No. 21 only 1 animal out of 74 died. This indicates, in the opinion of the writer, that, if disease is started in a herd, by the simultaneous treatment the loss will be of little consequence if the herd is carefully watched and reinjected with serum as soon as the first indication of trouble appears. The evidence so far at hand goes to show that the result obtained with Herd No. 11 will be met with very infrequently and the loss resulting from the simultaneous treatment will be so slight as not to be a serious objection to its use.

PREVENTING THE SPREAD OF A CHOLERA OUTBREAK BY VACCINATING AROUND ITS BORDERS.

Owing to lack of time and to the large amount of hyperimmune serum that would have been required, experiments for gaining information on this point were carried out in but one neighborhood. The appearance of disease in Herd No. 10 constituted a new center of infection, and it was decided to vaccinate the neighboring herds with a view to stamping out the disease in that locality; consequently all of the hogs in Herds Nos. 19, 22, 26, 27, 30, 33, and 34 were treated, no checks being left. These herds were all well when treated and continued so, with the exception of No. 22, which was showing indications of disease when vaccinated. The disease soon died out in this neighborhood, and it is impossible, therefore, to say whether or not the result would have been the same had the herds been left untreated. The disease in Herd No. 10 was not very virulent, but the appearance of cholera in No. 22 would indicate that but for the use of the hyperimmune serum the disease would probably have appeared in some of the other neighboring herds. As the serum used in these experiments was known to be potent, we have every reason to suppose that the herds in question would have been effectively protected against hog cholera had the disease in No. 10 been as virulent as that in some other neighborhoods.

While, therefore, we did not carry out extensive experiments as to the limiting of outbreaks of hog cholera by the use of serum, we nevertheless have reason to believe, judging by the results in this instance and by what was accomplished in individual herds, that outbreaks may be prevented from spreading and that the disease may even be stamped out by the prompt use of serum when new centers of infection are discovered.

EFFECT OF VACCINATION ON ANIMALS OF DIFFERENT AGES.

While a majority of the vaccinations herein recorded were made on spring shotes, a considerable number of old hogs (animals from 1½ to 3 years old) and quite a number of sucking pigs were treated in the different herds.

In the experiments with old hogs the number of checks was somewhat limited, as the owners were loath to leave any of them untreated on account of their greater value. In a number of herds, however, it was shown that old hogs were protected by the treatment, while the untreated ones died. Such was the case in Herds Nos. 10, 20, 29, 31, 35, and 42. In the opinion of the writer old hogs can be as successfully vaccinated as shotes.

As the field tests described in this article were carried out during the fall of the year, when as a rule there are but few sucking pigs, only a limited number of young pigs could be treated. However, in some herds where disease had recently appeared very striking results were obtained by treating a part of a litter and leaving the remainder untreated as checks, as is shown in the case of herds Nos. 31 and 35.

The results obtained in the various herds which were treated would certainly indicate that hogs of any age may be successfully protected against hog cholera in its various forms, whether mild or virulent, by a sufficient dose of hyperimmune serum.

CONCLUSIONS.

1. The serum of properly hyperimmunized hogs, when administered in sufficient doses, will protect nonimmune hogs of all ages against hog cholera. As indicated in the experiments which have been described, the following approximate doses should be used: For sucking pigs, from 10 to 15 c. c.; for shotes weighing from 30 to 200 pounds, from 20 to 30 c. c.; for old hogs, from 40 to 60 c. c. Later experiments, however, will probably show that as much as 60 c. c. is never required.

2. Healthy herds treated by the simultaneous method are rendered immune against hog cholera.

3. In herds recently infected with hog cholera, where only a few animals have become sick, nearly all loss may be prevented by the use of serum alone. The serum will not save those animals in the last stages of the period of incubation, but may be depended on to protect all of the uninfected animals and most of those in the early stages of the period of incubation. Simultaneous treatment in these herds appears to yield the same results as the serum when given alone except that the duration of immunity may be longer.

4. In badly infected herds, where the disease has made considerable headway, a number of the animals may be saved by the serum, the percentage saved depending upon the extent of the infection; that is, upon the number of unaffected or only slightly affected animals in the herd at the time of treatment.

5. By the prompt use of hyperimmune serum in an infected herd and the prompt vaccination of surrounding herds, hog cholera may be quickly stamped out when it first appears in new territory. In case the infection has already spread from one infected herd to several neighboring herds, the vaccination of all herds bordering on the infected area will prevent further spread of the disease.

6. The treatment of healthy shotes by the simultaneous method very rarely causes the appearance of disease, and should it do so it may be quickly controlled by the subsequent use of hyperimmune serum alone.

ACKNOWLEDGMENTS.

In conclusion, the writer desires to express his obligations to Dr. M. Dorset, chief of the Biochemic Division, under whose direction the field tests were made. The writer also acknowledges the valuable services of Dr. L. E. Day, veterinary inspector, who assisted in the injections and autopsies. Valuable assistance in the preparation of the serum and in the treatment of herds was also rendered by H. J. Shore, assistant bacteriologist. The writer is also under obligations to the owners of the treated herds who so willingly cooperated with us and thereby made possible the extensive field tests which have been described.

THE CONTROL OF HOG CHOLERA BY SERUM IMMUNIZATION.[a]

By A. D. Melvin, D. V. S.,
Chief of the Bureau of Animal Industry.

FACTS ON WHICH TREATMENT IS BASED.

As a result of experimental work conducted by the Biochemic Division of the Bureau of Animal Industry[b] and recorded in Circular 43 and in Bulletin 72 of this Bureau, the conclusion was reached that the so-called hog-cholera bacillus is not the true cause of hog cholera, but that this organism plays the part of a secondary invader, the true cause of the disease being a virus which is present in the blood of hogs affected with hog cholera, and which, under certain conditions of filtration, is capable of passing through the finest porcelain filters. Up to the present time this filterable virus has resisted all attempts at artificial cultivation, and we know of its presence only through the effect upon hogs when fluids from sick animals, free from all known bacteria, are injected into susceptible animals. It is a well-known fact that hogs which have recovered from an attack of hog cholera are completely immune when subsequently exposed to the same disease.

These two facts—the presence of the filterable virus in the blood of hogs sick of hog cholera and the immunity in hogs which have recovered from an attack of that disease—form the basis for the preparation of the serum which we have used successfully in immunizing hogs against cholera.

METHOD OF SECURING IMMUNE SERUM.

Without attempting to go into the method of producing this serum in detail, it will be sufficient to say that the protective serum is produced by a process of hyperimmunization carried out as follows:

An immune hog is injected with large amounts of blood from hogs sick of hog cholera. These injections will not produce more than a

[a] This paper was presented at the annual convention of the American Veterinary Medical Association, Philadelphia, Pa., September 10, 1908.

[b] The methods of immunization described herein have been arrived at by the Biochemic Division, and the investigations for the past four years have been under the direct supervision of Dr. M. Dorset, the chief of that division, through whom the Department of Agriculture has had the process patented in such manner as to insure to all the people in the United States the right to its use without the payment of royalty.

transitory effect upon the health of the immune, although they would prove certainly fatal to a susceptible hog. This treatment of immune hogs with large amounts of virulent blood is known as hyperimmunization, and gives to the blood of the immune the power to protect susceptible hogs from hog cholera. After a week or so, when the immune has recovered from the effects of this treatment, blood is drawn from that animal by cutting off the end of the tail. The blood drawing is repeated three or four times at intervals of a week, after which the immune is usually bled to death from the carotid artery. After each drawing from the immune the blood obtained is defibrinated and mixed with a suitable antiseptic. If preserved in sterile bottles, this defibrinated blood, or serum, as it is called, will retain its potency for years.

The protective serum having been obtained from an immune hog in the manner indicated, the potency of this serum is determined by injecting susceptible pigs with varying amounts, and at the same time exposing them to hog cholera along with untreated control animals. In practice it will of course be found best first to collect large quantities of serum and to mix this before testing. A standard serum will thus be secured at a minimum cost.

METHOD OF PROTECTING SUSCEPTIBLE HOGS.

A standard serum of known potency having been secured, either of two methods may be used for protecting susceptible pigs. These are known as (1) the "simultaneous" method and (2) the "serum-alone" method, or simply the serum method.

The first of these, which is to be recommended for use especially in herds which have not been exposed to hog cholera, consists in injecting subcutaneously on one side of the body of the pig to be vaccinated a suitable quantity of serum, and simultaneously on the other side of the body a small quantity of virulent blood taken from a hog sick of hog cholera. Experiments have shown that by this method pigs are given a firm immunity, lasting at least six months and probably longer.

The serum-alone method, which consists simply in the injection of the protective serum without the simultaneous use of virulent blood, appears to confer only a temporary immunity upon the treated pigs, unless they are exposed to hog cholera a short time after receiving the serum, in which case they also acquire a lasting immunity. For these reasons this method is admirably adapted to the treatment of hogs in a herd where hog cholera has already broken out, but which have not themselves shown visible symptoms of disease.

The experiments which are being carried out to determine the curative properties of the serum are not yet complete, but from the results thus far obtained we know that serum in the doses used for immuniza-

tion can not be depended upon to cure hogs which already show visible symptoms of hog cholera. Further work along this line is needed. Neither the simultaneous nor the serum-alone method, when properly applied, appears to injure the hog in any way.

COST OF THE SERUM.

In order to determine the cost of producing serum for practical use every item of cost would of course have to be taken into account and allowance made for all sources of revenue. Owing to the conditions under which the work of the Bureau has been carried on—that is, manufacturing serum for experimental use only and utilizing the same force for the production of the serum and for carrying on varied experiments—it is impossible to determine the exact cost of the serum thus far produced. Sufficient work has been done, however, for an estimate to be made. With the dose of serum at 20 cubic centimeters and with the production carried out with strict economy, it seems likely that the cost per dose can be brought within 25 cents. This estimate is based upon the supposition that each hyperimmunized immune will furnish 150 to 200 doses of serum, and that the carcass of the immune after final bleeding will be utilized for food. There seems to be no objection to the use of such a carcass for food purposes, provided the post-mortem examination discloses no reason for rejecting it.

I have recently been informed by Dr. C. E. Marshall, of the Michigan Agricultural College, who has begun the preparation of this serum for distribution to farmers in that State, that it is the purpose to charge at present 2 cents a cubic centimeter for the serum, though he hopes to be able to reduce the price materially before another season. It will undoubtedly prove to be true that the cost of the serum will vary with the conditions of manufacture, and the proportionate cost should decrease as the amount of serum produced increases. In any case it seems certain that the serum can be produced cheaply enough for practical purposes.

RESULTS OF PRACTICAL TESTS OF THE SERUM.

The statements made above concerning the protective power of serum from hyperimmunized immunes are based upon tests on several thousand hogs. These tests were carried out not only in small experiment pens, but in great part upon farms under practical conditions. During the fall of 1907 approximately 2,000 hogs were treated on 50 different farms, a considerable proportion of untreated hogs being left in all cases as a control on the action of the serum.[a] Both methods of treatment were used, and the herd conditions varied

[a] A report of these field tests appears elsewhere in this volume (pp. 177–217).

widely. The herds can be roughly classified as (1) those in an infected district, but themselves free from disease; (2) those known to have been exposed by contact with sick hogs, but which had not developed disease at the time of treatment; and (3) herds in which hog cholera was present and hogs were sick and dying at the time of treatment.

In no case were any of the ordinary methods of combating hog cholera by disinfection and separation of the sick from the apparently healthy practiced. Where disease was present at the time of treatment, the treated animals were allowed to run with the sick along with a number of untreated animals which served as controls, and the success following treatment can therefore be attributed to the action of the serum. In the herds where hog cholera appeared subsequent to treatment, practically all of the treated hogs remained well while more than 65 per cent of the checks died. In the herds which had been exposed but were apparently well at the time of treatment, 4 per cent of the treated animals died while approximately 90 per cent of the checks succumbed. In the herds where disease existed at the time of treatment, and where very great success was not expected, 13 per cent of the treated animals were lost, whereas 75 per cent of the checks died.

These successful field trials, confirming as they do numerous tests carried out under experimental conditions, have convinced us of the efficiency of this method of dealing with hog cholera; and although improvements will undoubtedly be made in many of the details of producing the serum, the method is believed to be now in such condition as to make the practical use of it entirely feasible.

CONFERENCES OF FEDERAL AND STATE REPRESENTATIVES.

In order that the States most concerned in this subject might be brought into closer relation with the work, and also for the purpose of discussing plans for effective coordination of State and Federal work in dealing with hog cholera, twenty-five of the chief hog-raising States were requested to send representatives to Ames, Iowa, where the Bureau of Animal Industry maintains a farm devoted to experiments with hog cholera. In response to this invitation representatives from twenty different States visited Ames and were shown the details of the serum production.

A general discussion at these conferences developed the practically unanimous opinion on the part of State and Federal representatives that the serum should be prepared by each of the States for distribution to the hog raisers, and all State representatives expressed their intention to undertake the work as soon as funds could be secured. At the present time a number of States have actually begun work. If the serum is prepared in sufficient quantities there seems to be no

doubt that a great saving can be effected simply by treating animals in exposed herds or in herds in which the disease has just appeared.

A PLAN FOR CONTROLLING AND ERADICATING HOG CHOLERA BY SERUM IMMUNIZATION.

If the greatest good is to be accomplished we should not be content simply to reduce the losses from hog cholera, but should undertake systematic efforts to eradicate the disease. The course which hog cholera usually takes when it appears in a neighborhood is well known. A herd develops the disease, which may not be recognized as hog cholera for several weeks after it has made its appearance. Following this the neighbors' hogs become infected and the disease spreads rapidly, the number of new foci increasing more rapidly as the infected area widens, until finally the losses in a single county may be enormous.

It is evident that in order to control the disease there must be some means of confining it to the original center of infection. This has been attempted by the British Government through the quarantine of farms where hog cholera exists and the slaughter of all infected animals. That such procedures alone do not yield the desired results is shown by the official reports of the continued prevalence of hog cholera in England. In the United States such methods would not be suitable, for, aside from the enormous expense involved, it would, in my opinion, be entirely impracticable to thoroughly disinfect extensive farm premises and to carry out a quarantine which would be effective against such carriers of disease as dogs, crows, buzzards, and other animals.

It has already been stated that the serum from hyperimmunized hogs can be used to protect hogs from hog cholera and that a large saving can be effected if the serum is applied promptly after the disease appears in a herd. Why, then, should not this serum be used as an agent for the eradication of hog cholera? It seems reasonable to believe that it can be used successfully for this purpose, but complete success can not be expected without proper organization and the direction of the work by health authorities.

In order that the possibilities of well-directed work along these lines may be brought to the attention of those who may in the future have this work to perform, the following plan for combating hog cholera through serum immunization is submitted:

1. The serum should be prepared by the State experiment stations or by State live-stock sanitary boards which are properly equipped with laboratory facilities, the efficacy of all serum to be determined by such laboratories before distribution.

2. The field application of the serum should be in the hands of the State live-stock sanitary board or State veterinarian.

3. The State should be organized into districts, each in charge of a deputy State veterinarian or a deputy appointed by the live-stock sanitary board. These districts should be small enough to permit the deputy to exercise close watch over them.

4. The deputy State veterinarian should keep a supply of serum on hand, so that prompt action may be taken when infection appears.

5. Hog raisers generally throughout the State should be informed when the serum is available for distribution, and if necessary compulsory notification of the presence of disease in a herd should be imposed.

6. Upon notification to the State live-stock sanitary board or State veterinarian that hog cholera has appeared in a certain neighborhood, the diseased herd or herds should be immediately quarantined, the premises disinfected as thoroughly as possible, and all hogs on the farm which have been exposed or which are not visibly ill should be treated with serum alone. All hogs on the farm which have not been exposed should be treated by the simultaneous method, and of course the prompt removal of dead animals should be enforced. At the same time all hogs on surrounding farms should be treated by the simultaneous method.

Prompt action of this kind should result in confining the disease to the first herd where disease appeared, though we must admit the possibility of infection being carried beyond the vaccinated belt by birds. If this should occur, the procedure should be the same as in the first case of disease, though the probability of dissemination by birds will not be great, owing to the comparatively small size of the infected area.

With a well-organized live-stock sanitary board and an efficient corps of deputies throughout the State, there seems to be no reason why hog cholera should not be kept well under control and perhaps in time eradicated by proceeding in the way indicated. By starting the work in early spring or summer the task would probably be much simplified and the cost reduced to a minimum.

Aside from the eradication of hog cholera, it seems that an important saving to swine breeders and to the hog industry in general can be accomplished through the protective inoculation of purebred hogs. Some of these hogs represent years of patient effort on the part of breeders, and their loss is a loss to the swine industry in general, which depends for its success in great measure upon the development and preservation of the superior characters possessed by these purebred animals.

There is no doubt that the hog raisers would gladly cooperate with the State authorities and that as a rule any outbreak of disease would be promptly reported, as the farmer would have everything to gain and nothing to lose by so doing.

INFECTIOUS ANEMIA, MYCOTIC LYMPHANGITIS, AND CHRONIC BACTERIAL DYSENTERY.

By John R. Mohler, V. M. D.,
Chief of the Pathological Division.

The three diseases known as infectious anemia (swamp fever), mycotic lymphangitis (pseudo-farcy), and chronic bacterial dysentery (Johne's disease) have recently been found to have a greater distribution in the United States than has heretofore been known, and they have therefore assumed importance to sanitary officers, not only on account of their own individual character but also because of the great similarity which they bear to other more common infections for which they may be readily mistaken. A brief discussion of the more important features of each of these three diseases is therefore given below.

INFECTIOUS ANEMIA.

Infectious anemia of horses, known also by a number of other names, as swamp fever, American surra, malarial fever, typhoid fever of horses, the unknown disease, no-name disease, plains paralysis, and pernicious anemia, has recently been the subject of much investigation. The cause of the disease has now been definitely determined as an invisible virus, which is capable of passing through the pores of the finest porcelain filter, like the infection of foot-and-mouth disease, rinderpest, hog cholera, and similar diseases. The disease is most prevalent in low-lying and badly drained sections of the country, although it has been found in altitudes as high as 7,500 feet on marshy pastures during wet seasons. Therefore proper drainage of infected pastures is indicated as a preventive. It is also more prevalent during wet years than in dry seasons. It usually makes its appearance in June, and increases in frequency until October, although the chronic cases may be seen in the winter, having been contracted during the warm season.

CAUSE OF THE DISEASE.

It has been conclusively proven that infectious anemia is produced by an invisible, filterable organism, which is transmissible to horses, mules, and asses by subcutaneous inoculation of blood serum. The virus which is present in the blood may be transmitted to a number of equines in a series of inoculations by injecting either the whole

10765—10——15

blood, the defibrinated blood, or the blood serum which has been passed through a fine Pasteur filter, thus eliminating all the visible forms of organismal life, including bacteria, trypanosoma, piroplasma, etc. This virus has also been found to be active in the carcass of an affected animal twenty-four hours after death.

Following the injection of the infectious principle there is a period of incubation which may extend from ten days to six weeks, at the end of which time the onset of the disease is manifested by a rise of temperature. If uncomplicated the infection runs a chronic course, terminating in death in from two months to one and a half years, or even longer. The probability of the virus being spread by an intermediate host such as flies, mosquitoes, internal parasites, etc., is now receiving careful investigation.

From experiments already made it appears that this disease, formerly supposed to be confined to Manitoba and Minnesota, is more or less prevalent in Kansas, Nebraska, Colorado, Wyoming, Montana, North Dakota, and Texas. It also occurs in Europe, having been reported in Germany under the name of infectious anemia and in France as infectious typho-anemia.

SYMPTOMS.

The disease is characterized by a progressive pernicious anemia, remittent fever, polyuria, and gradual emaciation in spite of a voracious appetite. It begins to manifest itself by a dull, listless appearance and by general weakness, the animal tiring very easily. This stage is followed closely by a staggering, swaying, uncertain gait, the hind limbs being mostly affected. (See fig. 23.) There is also noted a weakness and tenderness in the region of the loins, and at the same time the pulse increases in rapidity and may run as high as 70, though weak, stringy, and intermittent. The temperature may rise to 103° F. or higher, remaining high for several days, and then dropping, to rise again at irregular intervals. Toward the end of the disease the temperature occasionally remains persistently high. The horse may improve for a time, but usually this temporary improvement is followed by a more severe attack than the former one. Venous regurgitation is sometimes noticed in the jugular before death. Albumen appears in the urine in the advanced stages of the disease, while the quantity of urine passed is enormous in some cases. Death finally occurs from exhaustion or syncope.

The blood shows a slight decrease in the number of white blood cells, while there is a gradual but marked diminution of red corpuscles, the count running as low as 2,000,000 per cubic millimeter, the normal count being 7,000,000 per cubic millimeter. If the blood is drawn from such an animal, the resulting red clot will be about one-fifth of the amount drawn. Occasionally a slow dripping of

blood-tinged serum from the nostrils is observed as a result of this very thin blood oozing from the mucous membranes. Petechiæ, or small hemorrhagic points, are sometimes noticed on the nictitating membrane and conjunctiva of the eye, while paleness of the visible mucous membranes of the nose and mouth is usually in evidence, although they may have a yellow or mahogany tinge. Often a fluctuating, pendulous swelling may appear on the lower lip, point of elbow, sheath, legs, under the belly, or on some other pendent portion, especially late in the disease, which is indicative of poor circulation, thinning of the blood, and consequent loss of capillary action.

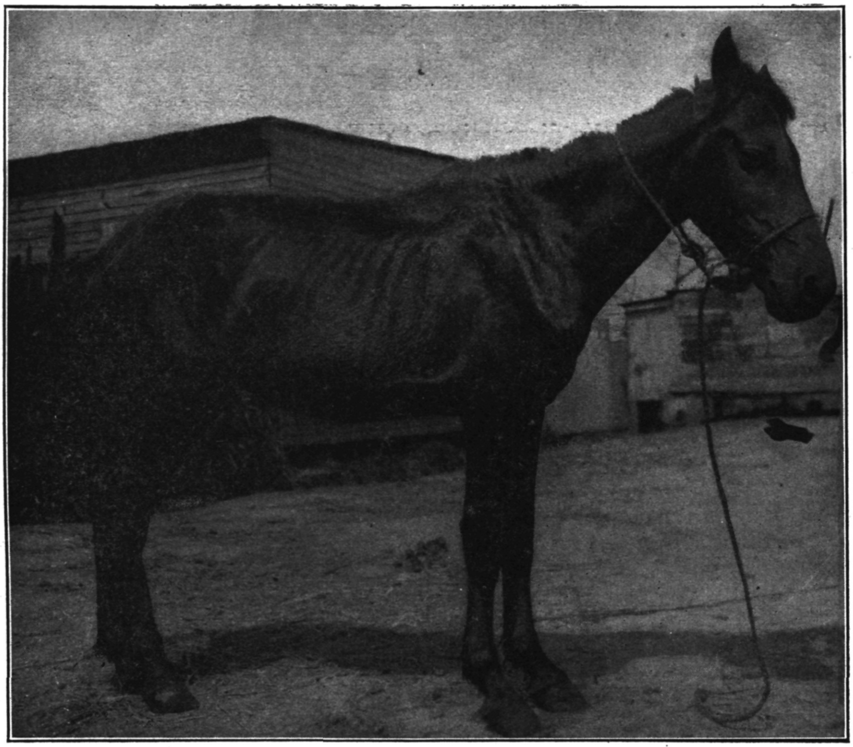

FIG. 23.—Horse in last stage of infectious anemia.

LESIONS.

After death the carcass is found to be very emaciated and anemic, the visible mucosa being very pale. The marked absence of adipose tissue makes the skinning of the animal a difficult task. Subcutaneous and intermuscular edema and hemorrhages are frequently observed, although it is remarkable in many cases how few macroscopic lesions may be present. The predominating and most constant lesion is probably the petechiæ so often observed in the muscle or on the

serous membranes of the heart. The heart is generally enlarged and may be the only organ to show evidence of disease. In other cases the lungs may be studded with petechiæ, with a serous exudate present in the thoracic cavity. In addition to the petechiæ already noted, the pericardial sac generally contains an increased amount of fluid. The abdominal cavity may show peritonitis and a hemorrhagic condition of the intestines, which probably result from overfeeding in consequence of the ravenous appetite. The liver sometimes presents a few areas of degeneration, although generally normal. The spleen is at times found to be enlarged and covered with petechiæ. The kidneys may appear normal or anemic and flaccid, but microscopically they usually show a chronic parenchymatous degeneration. Lymph glands may be enlarged and hemorrhagic.

DIAGNOSIS.

The diagnosis of the disease is not difficult, especially in advanced stages. The insidious onset, remittent fever, progressive emaciation and anemia, unimpaired or ravenous appetite, staggering gait, and polyuria are a train of symptoms which make the disease sufficiently characteristic to differentiate it from other diseases affecting horses in this country. The peculiar relapsing type of fever, the great reduction in the number of red blood cells, and the absence of eosinophilia are sufficient to differentiate it from the anemias produced by internal parasites, while it may be readily distinguished from surra by the nonsusceptibility of cattle and the great ease with which the trypanosoma may be found in the latter affection.

PROGNOSIS.

The prognosis of the disease is very unfavorable. Veterinarians in different sections of the country where the disease is prevalent report a mortality of 75 per cent, or even higher. Recovery takes place only when treatment is begun early or when the animal has a long convalescent period.

TREATMENT.

The treatment of the disease has so far been far from satisfactory. The iodid, permanganate, and carbonate of potash have been used. Arsenic, atoxyl, quinin, and silver preparations have been suggested, but all have uniformly been without success. Intestinal antiseptics have been resorted to, and the results are encouraging, but not altogether satisfactory. Symptomatic treatment seems to be the most dependable. For instance, Davison, of this Bureau, was able to reduce greatly the mortality from this affection by giving an antipyretic of 40 grains of quinin, 2 drams of acetanilid, and 30

grains of powdered nux vomica four times daily. In the late stages, with weak heart action, alcohol should be substituted for acetanilid. Cold-water sponge baths may be given, and in addition frequent copious injections of cold water per rectum, which has a beneficial effect in reducing the temperature and in stimulating peristalsis of the bowels, which, as a result of the disease, show a tendency to become torpid during the fever. The administration of purgatives should be avoided unless absolutely necessary, on account of their debilitating effect, but instead laxative, easily digestible feeds should be given. Not infrequently a dirty-yellowish tinge of the visible mucous membranes has been observed, in which cases 20 grains of calomel in from 2 to 4 drams of aloes in a ball, or 2-dram doses of fluid extract of podophyllin may be given. Following the subsidence of the fever a tonic should be administered, composed of the following drugs in combination:

Arsenious acid	grams	2
Powdered nux vomica	do	28
Powdered cinchona bark	do	85
Powdered gentian root	do	110

These should be well mixed and half a tablespoonful given at each feed to the affected animal.

As in the case of all other infectious diseases, the healthy should be separated from the sick horses, and thorough disinfection of the infected stable, stalls, litter, and stable utensils should be carried out in order to prevent the recurrence of the disease. As a disinfectant the compound solution of cresol, carbolic acid, or chlorid of lime may be used by mixing 6 ounces of any one of these chemicals with 1 gallon of water. One of the approved coal-tar sheep dips might also be used to advantage in a 5 per cent solution (6 ounces of dip to 1 gallon of water). The disinfectant solution should be applied liberally to all parts of the stable, and sufficient lime may be added to the carbolic-acid solution to make the disinfected area conspicuous.

Investigations are now in progress with a view of producing a vaccine or serum that will protect horses which have been exposed to the disease.

MYCOTIC LYMPHANGITIS.

This disease has been known as epizootic lymphangitis, otherwise pseudo-farcy, or Japanese farcy; it is a chronic contagious disease, particularly of equines, caused by a specific organism, the *Saccharomyces farciminosus*, and characterized by a suppurative inflammation of the subcutaneous lymph vessels and the neighboring lymph glands. Owing to the fact that this affection does not spread as an epizootic and that its causal factor is a yeastlike fungus, the name mycotic instead of epizootic lymphangitis is suggested. This disease was first

described by Italian and French veterinarians, and the specific organism was discovered by Rivolta in 1873. The presence of the disease in the United States was first observed by Pearson in Pennsylvania in 1907, although it is probable that it has existed in various parts of this country for many years. More recently its presence was definitely established in Ohio, Iowa, California, and North Dakota, and there is a probability of its existence in Indiana and several Western States. The disease is also present in the Philippine Islands, Hawaiian Islands, and Porto Rico.

BACTERIOLOGY.

The *Saccharomyces farciminosus* forms slightly ovoid bodies 3 to 5 microns long and 2.4 to 3.6 microns broad, which are somewhat pointed toward the poles and have a sharp double contour. They have more or less of a homogeneous content and grow by budding. This characteristic can be especially well observed in old growths on culture media. Their staining with the ordinary stains is quite unsatisfactory; they may, however, be readily recognized in fresh smear preparations or in the hanging drop of a small quantity of the suspected pus, where the above-described bodies can be distinctly noticed.

A satisfactory method of staining the organism is the Claudius method, which is as follows:

1. Stain with 1 per cent aqueous solution of methyl violet for two minutes.

3. Place in a half saturated solution of picric acid for one to two minutes.

4. Decolorize with chloroform or clove oil.

5. Treat with xylol.

6. Mount in Canada balsam.

The organisms grow very slowly in the various culture media. It requires about ten days before vegetation is noticed on agar in the form of grayish-white granules, which gradually grow to larger colonies, appearing considerably elevated and having a wrinkled surface. They also grow in bouillon, in which a white flaky deposit makes its appearance after fifteen or eighteen days. In taking cultures it is advisable to open a fluctuating abscess, over which the skin should be shaved and well cleaned with bichlorid solution and alcohol. The abscess should be opened with a sterilized scalpel, and culture media may then be inoculated in the usual way. In case of a mixed infection, the organism may be isolated by plating.

The period of incubation varies greatly, extending from three weeks to four months, or even longer. In artificial inoculations with pus through wounds in the skin, inflammation and swelling of the lymph vessels may be noticed in twenty to sixty days, and these vessels show in their course a development of hard nodules, from which abscesses form.

The natural infection is without doubt caused through superficial wounds, such as galls, barbed-wire cuts, or through various stable utensils, harness, bandages, insects, etc. Solipeds are mostly susceptible, but cattle may also be infected.

SYMPTOMS.

The inflammation of the lymph vessels is usually first observed on the extremities, especially on one or both hind legs (fig. 24); it may also appear on the fore legs, shoulder, or neck (figs. 25 and 26), and more rarely on the rump, udder, and scrotum. The lesions as a rule develop in the tissue adjacent to the place of inoculation. In the early stages of the disease the lymph vessels appear very hard and thickened, and along their course hard nodules develop, ranging in size from a pea to a hen's egg. Later these nodules soften, burst spontaneously, and discharge a thick yellowish pus. The surface of the resulting ulcers or abscess cavities soon fills up with exuberant granulations which protrude beyond the surface of the skin, giving a fungoid appearance. The affected extremities are considerably enlarged, similar to cases of simple lymphangitis. In rare cases the mucous membrane of the nostrils may also become affected, showing yellowish flat elevations and ulcerations, and these may extend by metastasis to internal organs. (See fig. 27.) In cases where the mucous membrane is affected the submaxillary lymph gland may also become enlarged and suppurate.

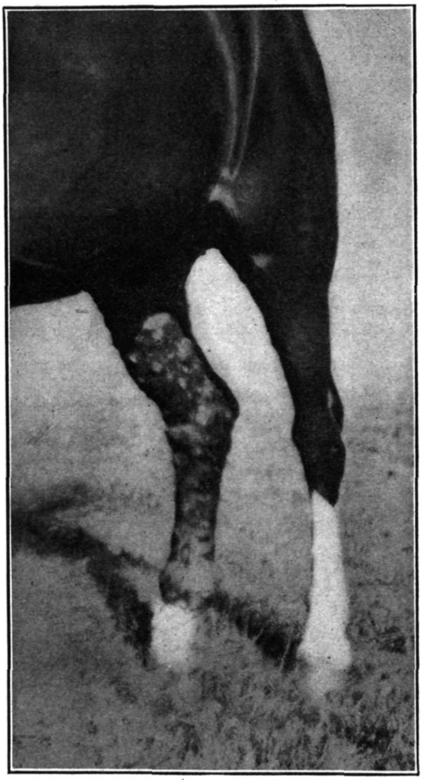

FIG. 24.—Mycotic lymphangitis in North Dakota mare.

The constitutional symptoms accompanying this disease are not very marked or may be altogether absent. There is usually only a very slight fever, which seldom runs over 102° F. The appetite is not impaired except in the advanced cases.

LESIONS.

The anatomical changes are most marked in the skin and the subcutaneous tissues. They may become 2 to 3 inches thick and

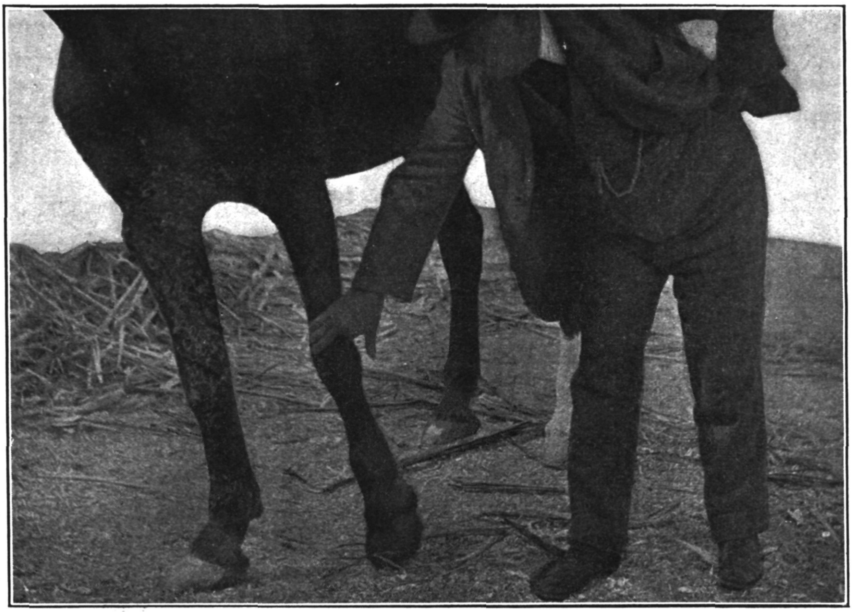

FIG. 25.—Mycotic lymphangitis on foreleg and shoulder of horse.

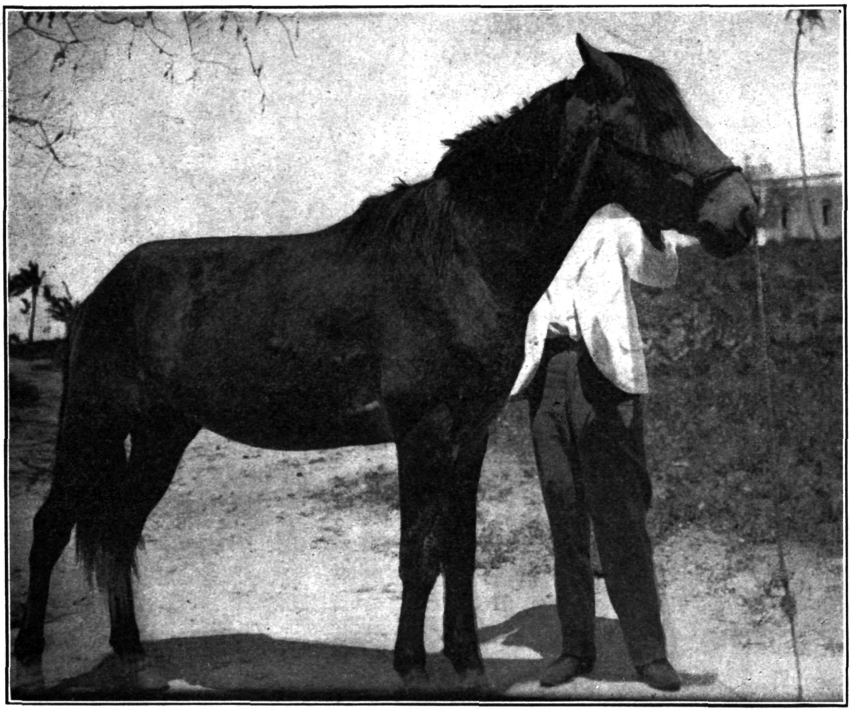

FIG. 26.—Mycotic lymphangitis in Porto Rican pony.

indurated as the result of fibrous-tissue formation, due to the inflammation present. On the baconlike cut surface suppurative areas and granulating sores may be noticed of various sizes, also enlarged lymph vessels filled with clotted lymph mixed with pus. The neighboring lymph glands are usually enlarged and frequently contain suppurating foci. Rarely the internal organs may show metastatic abscesses.

DIAGNOSIS.

The diagnosis is based on the characteristic appearance of the ulcerations, which show exuberant granulation of a bright-red color, inverted edges, and a thick, creamy, glutinous discharge. These manifestations differentiate the disease from glanders, in which the ulcers are craterlike, do not contain exuberant granulations, and the discharge is of a viscous, oily character. The submaxillary and other lymph nodes as well as the corded lymphatics in glanders are more firmly attached to the adjacent tissues, and are therefore less movable. In some chronic cases of mycotic lymphangitis, however, the lesions may closely resemble those of farcy, and in these cases the microscopical examination of the pus will disclose the nature of the affection. In the pus the saccharomyces can be easily seen in the unstained specimen and is recognized by its size, shape, and highly refractory double outline. Furthermore, the injection of mallein in cases of mycotic lymphangitis will be attended with negative results.

FIG. 27.—Mycotic lymphangitis in Philippine pony.

TREATMENT.

Treatment consists at the onset of the disease in entire extirpation of the nodules, lymph vessels, and neighboring lymph glands in case the lesions are localized. In cases where the nodules have formed abscesses their opening is recommended, followed by the application of the actual cautery or a 1 to 250 solution of bichlorid of mercury.

It must be borne in mind that the organism is highly resistant to almost every antiseptic, and the best results will be obtained from the application of a solution of a strong antiseptic following the opening of the lesions.

In the most favorable cases recovery results in from five to seven weeks; as a rule, however, it requires several months.

PROPHYLAXIS.

In order to prevent the spreading of the disease the affected animals should be isolated, the products of the disease should be destroyed, and the stable should be disinfected with very strong liquid disinfectants in consideration of the great resistance of the causative organism.

CHRONIC BACTERIAL DYSENTERY.

Chronic bacterial dysentery is a chronic infectious disease of bovines caused by an acid-fast bacillus simulating the tubercle bacillus. It is characterized by marked diarrhea, anemia, and emaciation, terminating in death. It has also been termed by various European investigators Johne's disease, chronic bacterial enteritis, chronic hypertrophic enteritis, and chronic bovine pseudo-tuberculosis enteritis.

Recently this disease has been observed in the United States for the first time by Pearson in Pennsylvania cattle, and later by Beebe in Minnesota and by Mohler in Virginia cattle and in an imported heifer from the Island of Jersey at the Athenia, N. J., quarantine station of the Bureau of Animal Industry. Pearson has proposed the name "chronic bacterial dysentery" for this affection.

The disease was first studied in 1895 by Johne and Frothingham in Dresden, but they were inclined to attribute the cause of the peculiar lesions of enteritis which they observed to the avian tubercle bacillus. In 1904 Markus reported the disease in Holland, and subsequently it was observed in Belgium, Switzerland, Denmark, and Great Britain.

CAUSE.

The bacillus which has been invariably demonstrated in the intestinal lesions and mesenteric lymph glands in this disease is a rod about 2 to 3 microns long and 0.5 micron wide. It stains more or less irregularly, like the tubercle bacillus, and, moreover, the similarity goes farther in that the organism is also strongly acid-fast, which facts led Johne and Frothingham to surmise that the disease was caused by avian tubercle bacilli. However, it has now been plainly demonstrated that the bacillus of chronic bacterial dysentery is readily distinguished from those organisms, for while it resembles the tubercle bacillus in form and staining qualities, no one has suc-

ceeded in growing it in culture media or in reproducing the disease by injecting experiment animals.

SYMPTOMS.

Probably the first symptom noticed is that the animal is losing condition despite the fact that its appetite is good and the feed nourishing. This is soon followed by a diarrhea which is moderate at first, but soon becomes excessive and may be either irregular or persistent, the feces being of the consistency of molasses and passed frequently. In the meantime the hair becomes dry and harsh and the animal falls off considerably in weight. (See fig. 28.) The temperature, however, remains about normal. The appetite does not seem to be greatly impaired until the last few weeks of life, but nevertheless emaciation continues, the animal becomes more and more anemic, great muscular weakness and exhaustion are manifested, and death follows, apparently as the result of the persistent diarrhea and great emaciation. The disease may continue for four or five weeks or may last for a year or even longer before death intervenes.

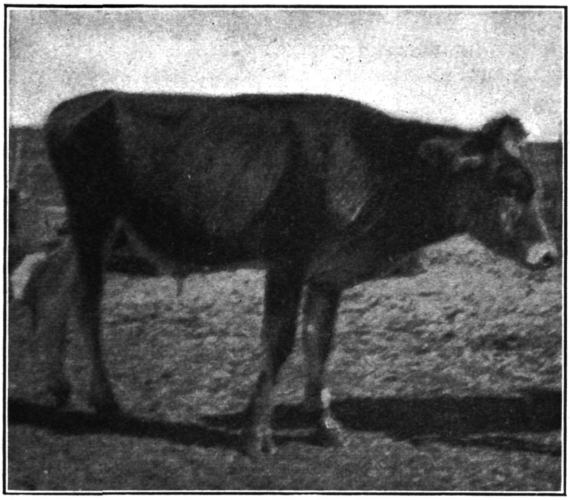

FIG. 28.—Steer affected with chronic bacterial dysentery.

LESIONS.

The lesions observed on post-mortem are remarkably slight and out of all proportion to the severity of the symptoms manifested. The disease appears to start in the small intestines, especially in the lower portion, where the lesions are usually the most marked, but it also involves the large intestines, including the rectum. The mucous membrane may alone be affected, although usually in the long-standing cases the submucosa is also invaded, and the entire intestinal wall is then much thicker than normal and the tissue infiltrated with an inflammatory exudate. The mucous membrane or inside lining membrane is markedly wrinkled or corrugated, showing large coarse folds with more or less reddening or hemorrhagic patches or spots on the summits of the ridges, especially noticeable in the large intestines.

The mesenteric lymph glands are usually somewhat enlarged and appear watery on section. The other organs do not appear to be affected except from the anemia present in the later stages of the disease.

DIFFERENTIAL DIAGNOSIS.

The principal disease with which bacterial dysentery may be confused is tuberculosis, but the application of the tuberculin test will readily diagnose the latter disease, while no reaction will be noted in case the injected animal is suffering with only the former affection. The disease may also be mistaken for the parasitic affections resulting from stomach worms (verminous gastritis) and intestinal parasites, especially uncinariasis, in which case a microscopic examination of the feces is necessary in order to establish definitely the diagnosis.

TREATMENT.

As with all other forms of infectious disease, it is advisable to separate immediately the diseased and suspected cattle from the healthy animals. The feces passed by the former should be placed on cultivated soil where healthy cattle would not be exposed to them, as the bacilli producing the disease are readily found in such manure. The stalls, stables, and barnyards should also be thoroughly disinfected, special attention being given to those places which have been soiled by feces.

The administration of medicines has thus far been quite unsatisfactory, although treatment should be directed toward disinfecting the intestines with intestinal antiseptics, such as creolin in 2-teaspoonful doses given twice daily. Salol, turpentine, or subnitrate of bismuth in a starch or wheat-flour gruel may also give temporary relief, but the diarrhea is likely to reappear and cause the death of the animal. In all cases the food must be carefully selected to assure good quality, and should consist preferably of nutritious dry feed.

THE EFFECT OF SMELTER FUMES UPON THE LIVE-STOCK INDUSTRY IN THE NORTHWEST.

By ROBERT J. FORMAD, V. M. D., M. D.,
Pathologist, Pathological Division.

INTRODUCTION.

Have smelter fumes and emanations any injurious effect on live stock? Have such effects ever been recognized, demonstrated, and recorded? Such questions could be asked only by the uninitiated, or by those who reside outside the regions where smelters are operated. These disastrous conditions are only too well known to the inhabitants of smelter districts in any part of the globe, as well as to those familiar with the literature of the subject, who have substantial evidence, descriptive and ocular, upon which to base affirmative answers. Both animal life and plant life have succumbed to the smelters' baneful influences. Owners of live stock in regions where smelters are operated have suffered such losses among animals and forage that stock raising has had to be decreased or even abandoned; and no region adjacent to a smelter is exempt from the blighting effects of the fume-laden atmosphere upon vegetation, forests, and all forms of animal life. In fact these two industries, live stock and smelting, can not coexist in the same locality when the ores used in the smelters contain arsenic. This is said with full appreciation of the relative character of the damage perpetrated. The quantity and quality of the ore treated as well as topographical conditions will influence the damage inflicted; however, in every instance it is found that the effect is detrimental and that the loss sustained bears a ratio to the amount of ore handled.

In Europe the effects of smelter fumes upon the live-stock industry have attracted the attention of investigators for more than a century, and the numerous data gathered by those workers have become history.

These earlier researches were directed principally toward the study of the damage to vegetation and forests from a botanical and chem-

ical standpoint, the injuries to plant life being more readily seen than those to animal life. Forest culture and the preservation of forests have reached a high state of perfection and are zealously guarded by European governments, while the raising of live stock is on a smaller scale than ours, and the animals are mostly sheltered in stables.

In England, following the establishment of alkali works in 1796, such great losses were sustained that one company paid annually to landowners and tenants for damages to trees, hedges, crops, etc. In 1820 the Swansea works were established and caused great damage, which was recognized and allowed by the courts in 1823 and again in 1832. In 1847 the towns improvement clause act was passed, in 1858 the local government act, later the smoke prevention act, then the smoke nuisance removal act, all of which bore upon this question.

In Germany, the valuable investigations by Stökhart in 1849, by Sussdorf in 1855, by Rosler in 1865, by Reich in 1867, by Freytag in 1870–1875, and by Haubner in 1878, are among the earlier scientific labors on this subject. The masterly descriptions by Freytag and Haubner of smelter-smoke conditions more than twenty-five years ago stand correct to-day almost without change. These works inspired the ablest scientists to investigate smelter conditions, and their results have corroborated Freytag's and Haubner's view that smelter fumes and flue dust are so injurious to the live-stock industry that the two industries are incompatible in the same district. The more recent contributions on the injurious effects of smelter smoke are so numerous that they have been placed in the bibliography at the close of this paper.

The German Government has enacted laws whereby the smelting of ores is permitted only on smelter reserves; that is to say, the smelting company has to acquire all the land within the radius over which the injuries of the smelter fumes extend.

In the United States, whatever governmental control of smelting may exist, it is safe to say that hitherto in the laws enacted no account has been taken of the havoc wrought by the poison-laden fumes upon vegetation or animal life. Here forest culture and protection does not receive the same care and attention as in Europe, although smelting is conducted on a much larger scale and the ores contain more sulphur and arsenic than in Europe. The fact that our live stock is handled in larger flocks or herds makes it more difficult to handle individual animals, and thus a longer time has been required for the recognition of a diseased condition in the herd and its possible intimate connection with deleterious effects of the smelter. Hence it is that in this country only in scattered instances has this surmise culminated in an appeal to the courts.

OUTLINE OF PRESENT INVESTIGATION.

The investigation described in this paper was undertaken by the direction of the Secretary of Agriculture in response to numerous appeals from stock growers and farmers of Deer Lodge Valley, Montana, who sustained such losses among their animals and crops that live-stock raising not only became unprofitable, but a number of ranchers were compelled to abandon their homes and improved land and seek a livelihood elsewhere. The writer was detailed to inspect the conditions of that locality and to take such material from animal tissues for microscopic examination as might appear necessary.

The geographic situation of the Washoe smelter near Anaconda, Mont., and of the Deer Lodge Valley have been minutely described in Bulletin 113 of the Bureau of Chemistry of the United States Department of Agriculture, hence it is unnecessary to give such a description in the present article.

In this connection it is only proper to acknowledge the generosity of the Deer Lodge Farmers' Association in offering to allow the writer to select and slaughter without payment of compensation any animal—horse, cow, steer, or sheep—on any ranch in their so-called smoke zone, as well as from the dairies, to be utilized for the purpose mentioned. Mr. E. P. Mathewson, general manager of the Anaconda Copper Mining Company, likewise extended a similar offer with regard to any animals on the company's premises, consisting of section 16 and the leased part of the Bliss ranch. These offers were gratefully accepted.

The inspection of Deer Lodge Valley and the collection of material for microscopic examination during the winter of 1906 extended over a period of forty-four days, from October 26 to December 8. It was ascertained first, by conversation with ranchers, what were the general conditions of the valley in which the losses were reported to occur, the extent of territory involved, the number of animals lost, the time of the year, and the localities where the greatest losses were sustained, also the character of the feed and water supply and the conditions under which the animals were kept. The representatives of the mining company, on the other hand, reported the flourishing condition of the animals on the company's premises, the abundant hay crops, etc.

The writer visited as many ranches as possible in the time mentioned, and inspected the pastures, soil, water supply, hay, sheds, and stables, as well as the physical condition of the available animals. This latter examination was usually made in conjunction with Dr. E. T. Davison, of the Bureau of Animal Industry, also on some occasions with Dr. D. E. Salmon, Dr. Leonard Pearson, and Doctor Cheney. The

ranches inspected were located in various directions from the smelter, and their distance on an air line from the smelter varied from $1\frac{1}{2}$ to 12 miles. While not every ranch came under observation, those that were investigated were thoroughly representative of the region subjected to the influence of flue dust. This region included almost the entire Deer Lodge Valley as well as the adjoining foothills. The injurious effects were sufficiently pronounced to be detected even on casual inspection, to say nothing of a close, careful, systematic investigation.

Twenty-one ranches were investigated, practically all of which were to the eastward of a line running north and south through the smelter; only one ranch was a little to the west of south, and situated about 4 miles from the smelter. Eight ranches were in a southeasterly direction, ranging from $1\frac{1}{2}$ to 7 miles in distance; two were due east, from 2 to 7 miles; seven were northeast, from 3 to 9 miles; and the farthermost three were north, from 9 to 12 miles.

The inspection itself varied considerably in character. Where the owner was prejudiced against an investigation and unwilling to give information or have his premises and animals inspected, the inspection was limited to a mere general inquiry as to the present state of hay and other crops harvested, the prices received for them, and the number of animals on hand as compared with the records of previous years. On the other hand, where the owner was disposed to sanction an investigation, it took the form of a minute inspection of the ranch, pastures, hay, water supply, shelters, sheds, stable, and barn, in addition to an examination of all live stock. On some ranches the writer was permitted to select and slaughter animals for the purpose of microscopic investigation, which must always be the court of last appeal in the consideration of damage to tissues.

It should be mentioned in this connection that the physical examination of range animals is not as easily accomplished as that of the eastern stable and pasture-reared animals. When an animal is used to roaming on the range, even if it is sick, it does not submit as kindly to an examination as the halter-broken animal. After such preliminary examination it was possible to form an opinion independent of the hearsay statements of ranchers on the one hand and of the representative of the mining company on the other hand.

CONDITIONS FOUND IN REGION OF SMELTER.

This inquiry and inspection revealed many interesting facts. In driving through the valley one could see apparently fine-looking pastures and meadows in which no stock had been allowed to run or from which no hay had been cut. The reason as explained by residents of the valley was that the grass was so noxious that it could

not be used with safety or profit. Even the hay, they said, was unsafe to feed and also unprofitable for sale. It is a well-known fact that Deer Lodge Valley hay, when there is any demand at all, sells for about 50 to 75 per cent less than the hay from outside the smoke zone. In many places stacks of 100 to 250 tons remained for several years unsold and thousands of tons of hay remained uncut in various parts of the valley. The claims of the residents in regard to the noxious properties of the grass and hay can be substantiated by the chemical analyses of Dr. J. K. Haywood, of the Bureau of Chemistry, as shown in the following table taken from Bulletin 113 of that Bureau:

Arsenic content of forage in Deer Lodge Valley, expressed as arsenious oxid, as determined by J. K. Haywood, U. S. Bureau of Chemistry.

[Calculated to dry basis.]

Serial No.	Description of sample.	Approximate distance and direction from smelter.	Arsenious oxid per gram of dry sample.	Arsenious oxid per 25 pounds avoirdupois of dry ration.	Water-soluble arsenious oxid per gram of dry sample.	Water-soluble arsenious oxid per 25 pounds avoirdupois of dry ration.
			Milligram.	*Grains.*	*Milligram.*	*Grains.*
4114	Bunch grass	2 miles N	0.103	18.0	0.083	14.5
4106	Alfalfa	2½ miles N	.069	12.1	.041	7.2
4115	Pasture grass	3 miles N	.069	12.1	.028	4.9
4117	Range grass	do	.054	9.5	.034	6.0
4116	Pasture grass	4 miles N., Lost Creek.	.041	7.2	.020	3.5
4107	Red top	4 miles NE	.028	4.9	.014	2.5
4118	Clover	do	.054	9.5	.028	4.9
4119	Range grass	do	.090	15.8	.020	3.5
4120	Alfalfa and clover (just cut).	4½ miles NE	.054	9.5	.020	3.5
4108	Red top	5 miles NE	.055	9.6	.028	4.9
4121	Range grass	do	.090	15.8	.069	12.1
4122	do	6 miles NE	.104	18.2	.041	7.2
4123	do	8 miles NE	.055	9.6	.028	4.9
4109	Alfalfa	10 miles NE	.070	12.3	.042	7.4
4124	Red top	1 mile SE	.069	12.1	.041	7.2
4112	Bunch grass	3 miles E	.042	7.4	.020	3.5
4110	Field grass	6 miles E	.055	9.6	.041	7.2
4111	Hay	do	.041	7.2	.028	4.9
4125	Range grass	4 miles W	.055	9.6	.028	4.9
4113	Bunch grass	6½ miles W	.055	9.6	.028	4.9

The analyses of Prof. R. E. Swain, of Leland Stanford Junior University, California, as published in the Journal of the American Chemical Society, Volume XXX, No. 6, June, 1898, and Prof. W. D. Harkins, of the University of Montana, in 1906, given below, likewise show the presence of a large amount of arsenic in grass, hay, and leaves and bark of trees resulting from smelter fumes.

Arsenic content of grass, hay, etc., in Deer Lodge Valley, as determined by Prof. W. D. Harkins, University of Montana.

Serial No.	Nature of sample.	Month.	Distance and direction from Anaconda.	Parts per million.[a]	Serial No.	Nature of sample.	Month.	Distance and direction from Anaconda.	Parts per million.[a]
			Miles.					*Miles.*	
38	Grass	February	5 SE	140	57	Grass	July	2 SW	508
39	...do	...do	5.5 N	180	58	...do	...do	0.7 SW	431
40	Hay	June	3 W	14	59	Hay	August	6 E	31
41	Grass	...do	4 W	99	60	Bark	...do	1.5 SW	300
42	Hay	...do	3 E	107	61	Leaves	...do	1.7 SW	683
43	...do	...do	4 E	18	62	Grass	...do	1.7 SW	482
44	Grass	July	4.2 N	12	63	...do	September	2.5 NW	81
45	...do	...do	8 NNE	111	64	...do	...do	2.5 SW	100
46	...do	...do	5 W	38	65	...do	...do	6 N	33
47	...do	...do	3 SE	21	66	...do	...do	4.2 N	34
48	...do	...do	1.5 SW	157	67	...do	...do	1 N	101
49	...do	...do	2 S	10	68	...do	...do	1 E	236
50	...do	...do	2 SW	359	69	...do	October	10 SW	64
51	...do	...do	1.5 SW	460	70	...do	...do	13 SW	38
52	...do	...do	1.7 SW	293	71	...do	...do	35 N	29
53	Leaves	...do	1.7 SW	583	72	...do	...do	34 N	21
54	Bark	...do	1.5 SW	350	73	...do	November	4.2 NNE	121
55	...do	...do	1.7 SW	376	74	...do	...do	6 NNE	73
56	Grass	...do	6 N	18	75	...do	...do	1.5 E	705

[a] Parts per million are equivalent to ten-thousandths of 1 per cent, and multiplied by 0.7 give the number of grains in 100 pounds of substance.

The presence of such large quantities of arsenic in the grass and hay, as shown by the chemical analyses referred to, would fully account for Deer Lodge Valley hay being less readily sold than hay raised elsewhere. Such hay would be undesirable feed for animals, and from an economic standpoint it would appear wiser to let it remain uncut than to incur the expense of cutting and stacking, when, if disposed of at all, it would bring only about the cost of putting it up.

LOSSES OF LIVE STOCK.

An attempt was made to ascertain approximately the extent of the losses in live stock sustained by the farmers in the smelter region during the period from 1902 to 1906. The writer endeavored to get as accurate a list as possible of the number of animals which each farmer had at the beginning and at the end of this period, and statements were obtained as to the holdings of 49 persons. The exact numbers were taken from books whenever possible, although most of the figures, especially for 1902, were necessarily estimates.

Considered in the aggregate, these reported losses were nothing short of appalling in magnitude. The notes show that out of a total of 2,447 horses in 1902 only 423 remained in 1906, and the losses in cattle were even greater. The decrease was said to be due almost entirely to deaths, as on account of the unthrifty condition of the animals there was practically no sale for them. Three men who undertook to raise sheep went out of the business, and five other ranchers also left the valley on account of their losses during this period.

A striking instance is afforded by the claim of one of the largest stock raisers of Deer Lodge Valley, whose ranch was about 12 miles from the smelter. According to his itemized statement his total losses during 1903 amounted to $31,582. He lost by death during that year 34 horses, 101 cattle, and 800 sheep, and animals that did not die were greatly damaged. He also claimed to have sustained losses and damage due to slunk calves, loss of milk, and damage to hay, pastures, etc.

A HISTORIC FEEDING EXPERIMENT.

The feeding experiment described below is inserted partly to show that the controversy regarding damage to live stock from smelter fumes is one of long standing, at any rate in Europe. The experiment took place in Germany forty-five years ago, and, as will be seen, was quite conclusive in its results. The work was carried out by a scientific commission under the personal supervision of Professor Stangel, the place being the agricultural academy farm at Tharand.[a] The object was to determine whether the forage in smelting regions produced any injurious effects on the health of cattle.

Two 6-year-old steers were used in the feeding trials, which lasted from June 7, 1864, to April 27, 1865. The experiment was divided into three periods. In the first period, from June 7 to August 20, the steers were fed in the following manner: One, the check animal, received daily 30 pounds of wholesome, sound hay, while the experimental steer received 30 pounds of hay that was pronounced to be damaged by smelter fumes to the extent of 40 per cent. During this period, lasting seventy-five days, no marked disturbances were noticed. The experimental animal consumed 29.68 pounds of hay daily, and increased in weight from 962 pounds to 1,025 pounds, or 63 pounds, which is an increase of 0.84 pound per day; while the check animal increased from 941 to 1,022 pounds, or 81 pounds, which is a daily increase of 1.08 pounds.

During the second period, lasting from August 21 to November 21, or ninety-three days, the experimental animal had diarrhea several times and the feces changed color and had an ill odor. The animal partook of but 25.62 pounds of hay daily and increased in weight from 1,003 to 1,072 pounds, which is a daily average of 0.74 pound. The check animal consumed the full ration of 30 pounds, and in-

[a] Reported by Freytag in "Jahrbuch für das Berg- und Hüttenwesen in Konigreiche Sachsen auf das Jahr 1873." There is apparently a discrepancy in the weights of the experiment animals as given at the end of the first period and at the beginning of the second period the following day, which the present author is unable to explain. The figures have been correctly copied from the German report. Whatever error there may be is not sufficient to affect materially the value of the result.

creased from 1,015 to 1,109 pounds, or an increase of 1.01 pounds per day.

Up to this point it appears that both animals gradually increased in weight, and that while the check animal continued to consume the maximum amount of hay per day, the experiment animal showed a gradually less desire to eat.

The feeding experiments were next continued by Commissioner Engel for the third period of one hundred and fifty-seven days, from November 22 to April 27. During this time the experimental steer consumed on an average but 21.4 pounds per day, and its body weight diminished from 1,070 to 1,045 pounds, which was a diminution of 0.17 pound per day. The check animal continued to eat 30 pounds of hay per day, increasing in weight from 1,109 to 1,210 pounds, which is an increase of 0.64 pound per day. On April 27 the check steer was sold, while the experiment animal was continued to be fed on hay from the smelter district from April 28 to November 8, or one hundred and ninety-five days. The reluctance to eat this hay increased to such an extent that toward the end of the experiment the animal consumed daily but 14 pounds of hay, the average during the entire period being 16.6 pounds per day. The body weight diminished from 1,045 to 820 pounds, a daily loss of 1.15 pounds.

LESIONS PRODUCED EXPERIMENTALLY.

The following experiment was made in order to test the effect of arsenic on horses and to compare the experimental results with the symptoms as found among animals in the vicinity of the smelter. The subject was a horse purchased at Rock Creek, Mont., in perfect health at the time of purchase and weighing about 850 pounds.

August 29, 1906, the animal was given 20 grains of white arsenic mixed with a little bran and water. August 30 it was given 40 grains of arsenic in solution mixed with the bran.

August 31 the animal appeared less bright, appetite not quite so good. Pulse, which had been full and strong, is not easily felt, owing to the bad disposition of the animal. The animal received again 40 grains of arsenic in solution as on the preceding day.

September 1. General condition unchanged; apparently normal amount of urine has been voided, and natural droppings. The animal again received 40 grains of arsenic in solution.

September 2. Animal is sick; no appetite; appears dull; walks very stiffly; droppings covered with thick, stringy, white mucus; respiration accelerated; pulse almost imperceptible; urine voided in small quantity; temperature 102.1° F.; staring coat. Forty grains of arsenic solution were mixed with bran and oats, but the animal would eat but a few mouthfuls and took not to exceed one-tenth.

September 3. Animal looks somewhat brighter, but has no appetite and walks in a stiff, uncertain manner; mucous membranes red; pulse almost imperceptible; temperature 100.8° F.; drinks very little. Forty grains of arsenical solution injected into the pharynx with a syringe.

September 4. Animal very dull and drowsy; has no appetite; drinks little; droppings very soft; visible mucous membranes much congested; submaxillary artery at the jaw is tender and full, but the pulse is weak, almost imperceptible, could not be counted; heart beats quick, jerky, but not hard, 87 per minute; respiration 21; temperature 100.7° F.; animal scarcely able to walk on account of progressive paralysis affecting the limbs, particularly the posterior ones. Forty grains of arsenical solution injected in the same manner as on the previous day, of which the animal swallowed about one-half.

September 5. Animal more drowsy and weaker than on the previous day; sways in walking; inclination to lift hind feet higher than usual rather than to drag them; mucous membranes very red; erosions above upper incisors; respiration easy, 20 per minute; heart beats quickly, 87 per minute; temperature, 99.8° F.; no signs of pain. The general appearance would indicate that the animal can live but a short time. No arsenic given that day.

September 6. Animal died at 10 a. m.

ARTIFICIAL PRODUCTION OF ARSENIC ULCERS.

Dr. D. E. Salmon produced experimentally ulcers that were identical with the "sore nose" of horses in Deer Lodge Valley. The animal experimented upon was a horse kept in a stable at Para's ranch and not allowed to go out on the pasture. It was fed hay purchased from outside the valley, so that there should be no question of any other influence. An arsenical paste was made by mixing white arsenic with water to a semiliquid consistency, and this was applied to the nasal septum with a little swab consisting of a tuft of cotton wrapped around the end of a stick. The details of the experiment follow.

October 3, 1906. Paste applied to nasal septum.

October 4. No visible effect; application repeated.

October 5. Irritation of the mucous membrane seen at the seat of application. No application.

October 6. Thickening of the mucous membrane; the appearance similar to the early stages of erosion preceding the formation of ulcers acquired by animals in pasture.

October 7. No application made.

October 8. The horse has a small sore where the arsenic was applied.

October 9. No application made.

October 10. The horse has a distinct sore in the nostril nearly half an inch in diameter. It is in the nature of a superficial erosion.

October 11. No application made.

October 12. The sore in the nostril has become larger; still superficial. Application continued.

October 13. Horse has two ulcers in the nostril which became confluent, also a fissure extending along the floor of the nostril and marking the course taken by the slight flow of the nasal secretion. The ulcers and fissure were similar to those seen in the nose of a horse which contracted ulcers naturally while in pasture, the animals having been brought together and the ulcers examined and compared.

October 14. Application repeated and the ulcer became more pronounced.

October 15. The ulcer is now one and one-half inches long by half an inch wide, covered with a thick black crust. Other crusts have formed on the skin

and mucous membrane surrounding it. The sore is slightly moist, sufficient to make the dust adhere, but there is little if any suppuration. Where the moisture from the nostril has trickled over and dropped from the horse a fissure or superficial crack has formed below the ulcer.

This condition in every respect resembles the naturally formed ulcers in the noses of three other horses that have been in pasture at Para's ranch, where this animal was kept, even to the fissures below the ulcers.

Similar ulcers were produced by the application of flue-dust paste prepared and applied by Doctor Cheney to the nostrils of two horses that were also kept at Para's ranch.

CLINICAL SYMPTOMS.

The clinical symptoms shown by the live stock in Deer Lodge Valley presented great variations, depending upon whether the animals subsisted exclusively on the valley forage or received additional feed raised outside of the smoke zone. Animals raised for the market were usually grazed all the year on the foothills. During the last few years it became necessary to bring them down to the valley and meadows during the winter months and feed hay. This in itself diminished the profit of stock raising. Taking into consideration the presence of a considerable amount of arsenic in the hay, as shown by chemical analysis, it becomes quite apparent that animals could not thrive on such feed; in fact, it would only be a question of time before they would become nonsalable and eventually die. Animals raised for utility, as horses and dairy cows, receive grain, bran, and hay raised outside of Deer Lodge Valley. Such animals show symptoms in a less pronounced manner than the range-reared animals.

The use of certain condition powders to counteract the effect of the valley hay appears to have had considerable success in experimental determinations, though, unfortunately, the facts were not made public and the community could not benefit by the results of those demonstrations. Lastly, some of the more valuable breeding animals (stallions) were fed exclusively on forage from outside the Deer Lodge Valley, which made their maintenance quite expensive, but such procedure was necessary to prevent illness and eventual loss, as was borne out by experience when this precaution was not adopted.

Another way in which the contaminated forage of the smoke zone has crippled, paralyzed, and in some parts completely wiped out the live-stock industry in the Deer Lodge Valley is by bringing about failure of conception, abortion, and finally causing sterility. According to location, the losses from the failure of conception and abortion vary from 30 to 60 per cent.

SYMPTOMS IN CATTLE.

The symptoms in cattle manifest themselves by general unthriftiness; languid, listless expression; eyes often inflamed; puffiness and

tumefaction constantly present around the eyes, frequently accompanied by lachrymation and ophthalmia; dry muzzle; salivation; profuse mucous discharge from nostrils; pronounced garlicky odor of breath; ragged, shaggy coat; skin dry, brittle, and closely adherent to the adjacent parts ("hidebound"). The affected animal often droops its head; the back is frequently arched; tail retracted between hind quarters; abdomen tucked up; appetite impaired; there is loss of flesh and in many cases great emaciation; weakness of hind quarters; staggering; temperature elevated; pulse rapid, soft, and

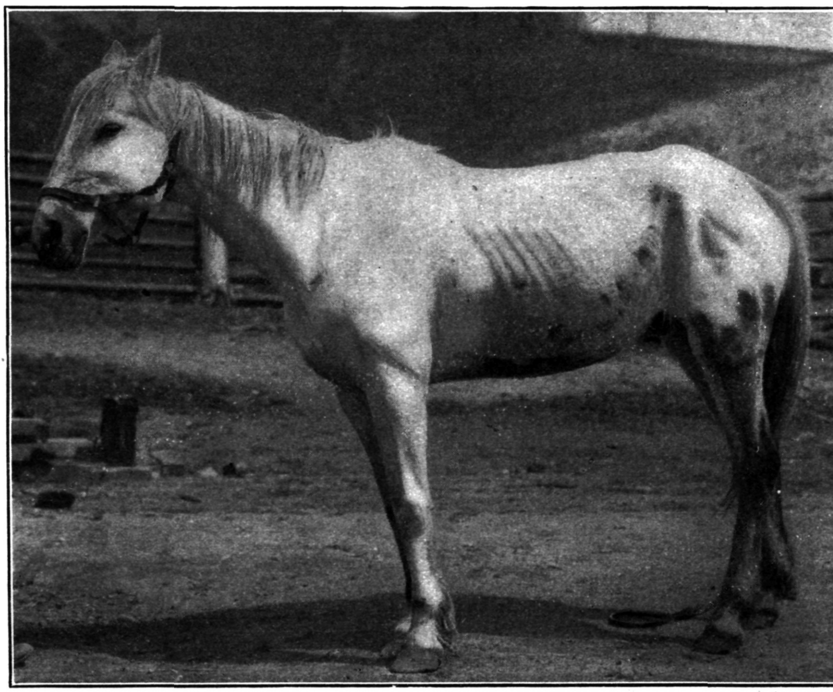

FIG. 29.—Horse showing general unthriftiness and several areas denuded of hair, due to arsenic poisoning from smelter. This animal was the last of 17 head, and died ten days after picture was taken.

almost imperceptible; respiration shallow and hurried; fetid, profuse diarrhea; droppings dark in color, squashy or pulpy in consistency, and covered with mucus. Abortion is very common in pregnant animals, and frequent failure of conception ultimately results in sterility. Shrinkage in milk yield and finally complete suppression of lactation in the milch cow are not infrequent.

SYMPTOMS IN HORSES.

The unthriftiness in horses (see fig. 29) is even more pronounced than in cattle, owing to the sanguinary temperament of the animals. The hair loses its natural luster, the animal appears shaggy, and the

coat is often covered by tufts of hair that have not been shed for a year or more. The skin is dry, hard, and brittle, with extensive falling of hair, forming bald areas in the more chronic cases. The spirit and vigor of the animal are lost to a great extent, and the endurance is so impaired that even a moderate amount of exercise causes fatigue and profuse sweating. There are also weakness, loss of muscular coordination of hind quarters, and a stiff, stilty, staggering gait, frequently followed by paralysis of the hind limbs. The vision often becomes deficient, causing the animal to shy readily. Occasionally blindness is induced from ophthalmia of long standing and from ulceration and staphyloma of the cornea. Dilatation of the pupils and puffiness around the eyes are exceedingly common. Pronounced garlicky odor of breath is a constant manifestation. The gum line is very prominent, swollen, and of bluish-gray color.

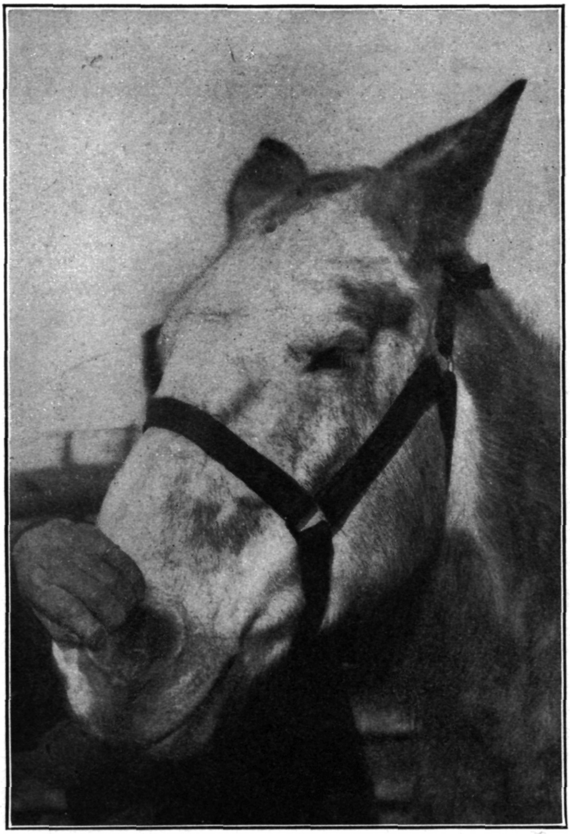

FIG. 30.—Filly with nasal ulcers as result of pasturing but a short time on a ranch about 10 miles northeast from smelter.

The nasal ulcer so characteristic and prevalent among the horses running on pasture during the fall and winter months in the smoke zone of Deer Lodge Valley is seen in all stages of development. (See Pl. IV and figs. 30 to 34.) It begins near the orifice, below the lachrymal duct on the side next to the septum, and appears to be produced by a severe local irritant. In the earliest stages the ulcer manifests itself as a small red area one-quarter to one-half inch in diameter. The mucous membrane is swollen at the seat of irritation; this is followed by an excoriation of

ULCERS IN NOSTRILS OF HORSE CAUSED BY ARSENIC POISONING FROM SMELTER.

This specimen was taken from an animal that had been on pasture but a few weeks about 3½ miles from smelter.

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the upper layers of the epithelium, then an erosion, and is finally succeeded by the formation of an ulcer, which may be so shallow as to involve only the epithelial lining of the mucous membrane or may be deep enough almost to penetrate the nasal septum. The surface of the ulcer is covered by an inflammatory exudate, which is tightly adherent to the ulcer. The ulcer readily yields to treatment of the ordinary antiseptic solutions if the animal is stabled or corralled. Spontaneous recovery may also take place, as is indicated by the scars or cicatrices in the noses of many horses. The cicatrices frequently cause almost complete occlusion of the nostrils.

It has been suggested that the awns of foxtail produce these nasal ulcers, but such a supposition would be entirely out of the question, as the foxtail awns would more likely become lodged in the outer wall of the nasal passage than on the inner wall, where the characteristic ulcer is found. Besides, the suppuration around a foxtail awn is so infrequent, owing to the great vascularity of the part, and the damage to the tissues so limited, that no true ulcer can be formed and the injured part heals without leaving a scar. On the other hand, the nasal ulcers in Deer Lodge Valley are identical with ulcers produced experimentally by the application of white arsenic and by flue dust by Doctor Salmon, and exactly resemble the slough produced from the application of white arsenic to warts, tumors, etc.

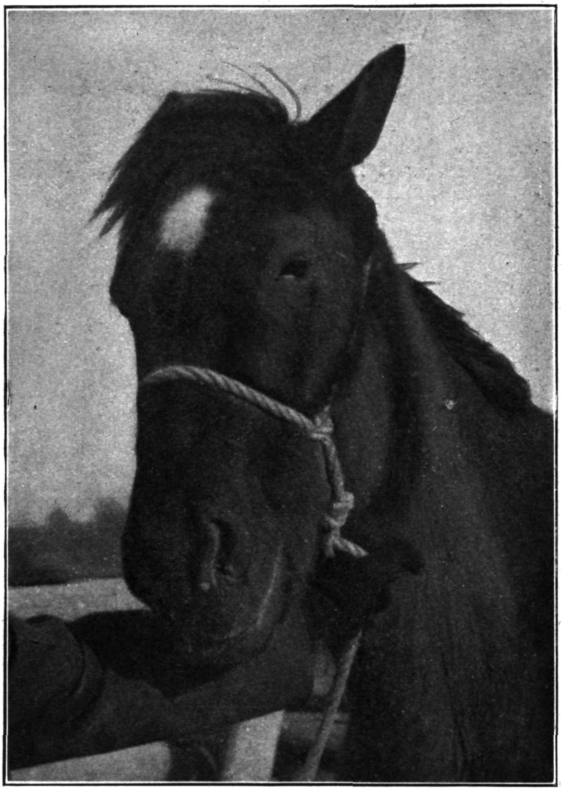

FIG. 31.—Horse with nasal ulcers which developed while pasturing on a ranch about 4 miles northeast from smelter.

While the nasal ulcer is more prevalent during the fall and winter months, it may appear at any time. During the spring and summer, while the grass is growing rapidly and rains are frequent, not enough arsenic will accumulate on the vegetation to occasion very

serious symptoms in animals grazing thereon or to cause the sore noses so prevalent at other seasons of the year.

POST-MORTEM NOTES.

The object of the post-mortem examinations was to collect material for microscopic examination; hence only brief memoranda of the most salient lesions were made, rather than a detailed description of all the changes found. The total number of animals autopsied was 21, including 11 horses, 7 cattle, and 3 sheep. Seventeen of these animals were killed, while 4 had died. In addition, the remnants of a cow and fetal calf found by the roadside were examined.

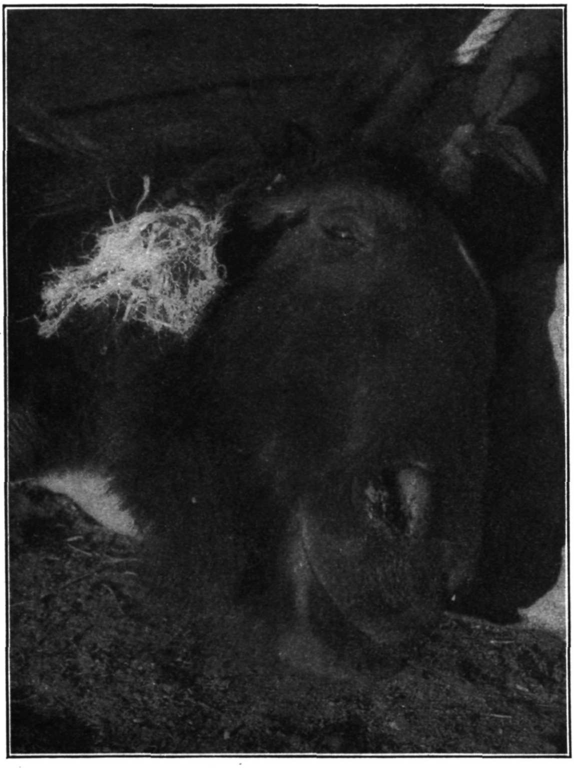

FIG. 32.—Colt with extensive nasal ulcers of recent origin. This colt was unbroken and was cast in order to get photograph.

Most of the tissues taken were fixed in Zenker's fluid. A limited number were fixed in Fleming's solution and some in a 10 per cent solution of formaldehyde. Four pieces were usually taken of the more important organs concerned in the elimination, as the kidneys, the liver, and the lungs, also of the stomach and the intestines, while only two pieces were taken of the organs less commonly affected, as the spleen, the heart, and the reproductive and nervous systems.

CASE 1.

Colt, owned by Walter C. Staton. The animal was killed October 28, 1906, on Staton's lower ranch by shooting through the neck and bleeding. General condition unthrifty; much long hair; strong garlicky odor from nostrils; large ulcer in each nostril; gum zone prominent; trachea congested; lung congested, not resilient to touch; pleura thickened; heart firm; pericardium contained some yellow-colored effusion; abdominal cavity contained a considerable amount

of transparent yellow effusion; stomach, characteristic appearance found in affected animals in Deer Lodge Valley, namely, reddish brown in color, walls thickened and in a state of chronic catarrh; serous surface of small intestine pale, mucous membrane congested; liver, greenish bile discoloration; spleen enlarged and pigmented; kidneys enlarged and congested; brain apparently normal; fat more yellow than normal.

The following tissues were taken for microscopic examination: Ulcer from nose; lung, liver, kidney, heart, spleen, these being placed in Zenker's fluid; cerebrum and cerebellum put in 10 per cent formaldehyde.

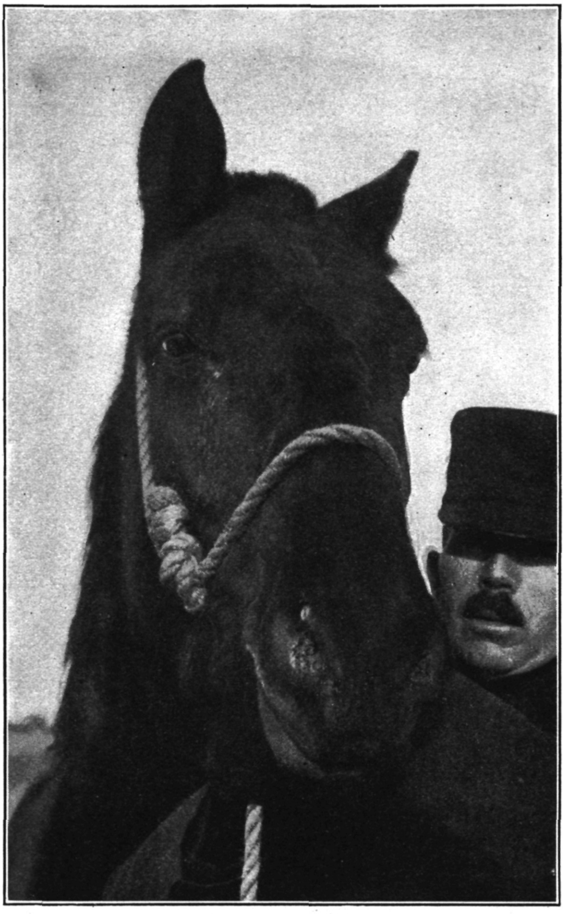

FIG. 33.—Horse showing pronounced nasal ulcers. The animal was pastured but a short time on a farm distant about 3½ miles northeast from smelter.

CASE 2.

Bay gelding, aged 3, owned by Thomas Elliott. Animal killed November 2, 1906, by shooting through the neck and bleeding. General condition unthrifty; strong garlicky odor from nostrils; prominent gum line; ulcer in left nasal orifice; trachea congested; lungs slightly catarrhal and emphysema in anterior tips of both lobes; heart hypertrophied; stomach in a state of chronic catarrh, a few bots present at the pyloric orifice; small intestine slightly catarrhal; duodenum contained a countless number of bots; large intestines contained a few sclerostomes; liver congested and bile-stained; both kidneys congested and enlarged; suprarenals enlarged; spleen enlarged; pancreas hypertrophied; bladder congested.

Tissues taken for microscopic examination: Lung, liver, kidneys, stomach and pancreas, heart, bladder and adrenal, spleen, these being placed in Zenker's fluid; kidney and liver in Fleming's solution.

CASE 3.

Bay gelding, owned by Nels Pierson. Animal killed November 2 on Staton's lower ranch by shooting through neck and bleeding. General condition un-

thrifty; edema around eyes; marked garlicky odor from nostrils; prominent gum line; ulcer in nasal orifice; trachea congested; lungs apparently normal, except a few small congested areas; heart hypertrophied, very firm; stomach in a state of chronic catarrh; liver apparently normal on macroscopic inspection; spleen enlarged and greatly pigmented; both kidneys slightly congested, about normal in size; pancreas, adrenals, and bladder apparently normal.

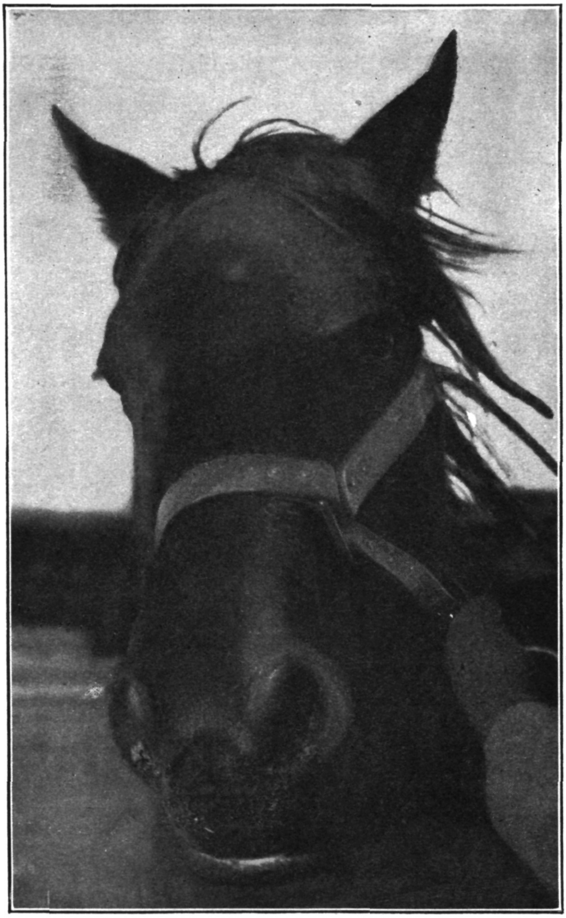

FIG. 34.—Mare showing healing ulcers in nostrils. Animal was taken from pasture and treated locally with carbolic acid and sweet oil. Distance about 9 miles north from smelter.

Tissues taken for microscopic examination: Lung, liver, kidneys, heart, stomach, spleen; all placed in Zenker's fluid.

CASE 4.

Bay gelding, owned by N. Bielenberg. Animal killed November 4, 1906, on P. Lappin's ranch, by shooting through the neck and bleeding. General condition unthrifty; strong garlicky odor from nostrils; puffy swelling around eyes; prominent gum line; erosion in both nostrils, but no ulceration; trachea congested; lungs have mottled appearance from patches of congestion with the tips of anterior lobes emphysematous and atrophic; pleura greatly thickened; heart hypertrophied and fairly soft in consistency; endocardium thickened; stomach inflamed, coated with mucus, and in state of chronic catarrh; small intestines congested in places, especially the jejunum, which had a number of congested areas 1 to 1½ inches in size; liver hyperthrophied, bile-stained, and covered by a goodly number of tufts; the fat throughout the body was very yellow in color; spleen enlarged and pigmented; kidneys congested, catarrhal; adrenals enlarged; pancreas and salivary glands, especially the parotid, were edematous; bladder congested; brain and cord congested; a considerable amount of cerebrospinal fluid was present.

Tissues taken for microscopic examination: Lung, pancreas, adrenals, and liver, kidney, heart, stomach, intestines, in Zenker's fluid; cerebrum and cerebellum, spinal cord, and eye in 10 per cent formaldehyde.

CASE 5.

Remnants of cow and fetal calf by the roadside, about a quarter of a mile from P. Lappin's ranch, were examined November 9, 1906. The organs appeared somewhat abnormal, especially the stomach and liver, which were congested; spleen enlarged; kidneys not present.

Tissues taken for microscopic examination: Liver, stomach, spleen, ovary, in Zenker's fluid; stomach and fetal tissues in 10 per cent formaldehyde.

CASE 6.

Calf about 6 months old, owned by P. Lappin. Animal killed November 9, 1906, by bleeding, on Lappin's ranch. General condition unthrifty, emaciated; trachea slightly congested; lungs apparently normal, anemic; all of the abdominal viscera anemic; the first three stomachs contained a fair amount of food and were apparently normal, as was the fourth stomach; small and large intestines pale but otherwise normal; mesenteric lymph glands considerably enlarged; liver, kidneys, spleen, pancreas, and reproductive organs apparently normal.

Tissues taken for microscopic examination: Lung, liver and lung, kidney and lymph glands, stomach, ovary, in Zenker's fluid; lymph glands in 10 per cent formaldehyde.

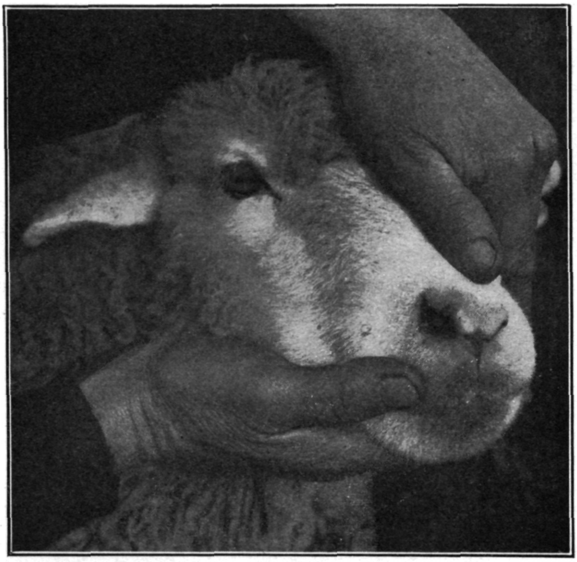

FIG. 35.—Sheep with ulcers in the nose. Out of a flock of 60 pastured about 10 miles north of smelter, 10 were examined, and 3 of these had nasal ulcers.

CASE 7.

Sheep owned by Deer Lodge Farmers' Association. Animal killed November 11, 1906, by bleeding, on Para's ranch. General condition fair; trachea congested; lungs anemic, apparently normal; fourth stomach considerably congested; small intestines contained a number of inextensive, slightly congested areas; heart, liver, spleen, and glands apparently normal; kidneys slightly congested and enlarged.

Tissues taken for microscopic examination: Lung, kidney, stomach, heart, spleen, all in Zenker's fluid.

CASE 8.

Idaho steer, owned by the Anaconda Copper Mining Company. Animal killed November 16, 1906, on section 16, company's ranch, by shooting and bleeding. General condition of animal very good; mucous membrane of trachea congested; lungs apparently normal; first three stomachs apparently normal, while fourth stomach was slightly congested; small intestines appar-

ently normal, with the exception of enlargement of the Pyer's patches and the mesenteric glands. A few small areas of localized congestion were present in the jejunum. Liver, heart, spleen, pancreas, and salivary glands apparently normal; adrenals enlarged; kidneys slightly congested; bladder apparently normal. An ulcer on the anterior portion of the tongue was probably of traumatic origin.

Tissues taken for microscopic examination: Lung, liver and pancreas, kidney, stomach, intestines, heart, spleen, mucous membrane from trachea, ulcer from tongue, in Zenker's fluid; intestines in 10 per cent formaldehyde.

Case 9.

Black cow, owned by George Cammack. Died and autopsied on Cammack's ranch while the carcass was still warm, November 17, 1906. General condition quite good; trachea congested; lungs congested, inflamed, and adherent to walls of chest in several places; pleura greatly thickened; pericardium greatly thickened and excessively distended by dark-brownish liquid of foul odor; heart hypertrophied; abdomen contained a large quantity of transparent yellowish liquid; liver very large, weighing 25 pounds, very firm in consistency, stained by bile pigments, and in a state of hypertrophic cirrhosis and streaked with blood; fourth stomach intensely inflamed, several small necrotic areas being present; both small and large intestines intensely inflamed throughout, walls greatly thickened from accumulation of transparent liquid between serous and muscular coats; kidneys presented a mottled appearance of deep red and light areas on the surface, while on section several anemic infarcts were present in the medulla of the organ; adrenals enlarged; pancreas hypertrophied; bladder inflamed.

Tissues taken for microscopic examination: Lung, liver, kidney, stomach, heart, pericardium, all in Zenker's fluid.

Case 10.

Brown-and-white cow, owned by John Furst. Animal killed November 18, 1906, by shooting and bleeding on Furst's ranch. General condition fair; trachea congested; lungs crepitant and apparently normal; heart flabby, some effusion in pericardium; true stomach slightly congested; both small and large intestines showed limited congested areas; liver had marked cirrhosis, was bile-stained, and had a number of tufts on the surface; kidneys slightly congested in cortical portion; spleen enlarged; pancreas, adrenals, and bladder apparently unaffected.

Tissues taken for microscopic examination: Lung, liver, kidneys, stomach, heart, spleen, all in Zenker's fluid.

Case 11.

Bay mare, owned by John Furst. Animal killed November 18, 1906, on Furst's ranch by shooting through neck and bleeding. General condition fair. This animal had previously broken its left fetlock and was hobbling on three legs. Trachea congested; lungs congested; heart slightly enlarged; marked congestion of the stomach. Both small and large intestines were congested, more particularly the former, which were in a catarrhal condition. Pancreas apparently unaffected; kidneys congested; adrenals enlarged; spleen congested and enlarged; bladder slightly congested.

Tissues taken for microscopic examination: Liver, kidney, stomach, all in Zenker's fluid.

CASE 12.

Horse, owned by State Senator Harper. Spontaneous death; animal autopsied on city dump November 26, 1906. General condition fair; trachea congested; pronounced congestion and inflammation of lungs; pleura thickened; stomach inflamed, in state of chronic catarrh; both small and large intestines intensely congested; liver hypertrophied, congested, with abundant connective tissue visible to the naked eye; spleen enlarged and pigmented.

Tissues taken for microscopic examination: Lung, kidney, stomach, intestines, stomach, all in Zenker's fluid.

CASE 13.

Sheep, owned by N. Bielenberg. Spontaneous death; autopsied on Bielenberg's ranch November 27, 1906. General condition fair; no evidence of decomposition; trachea congested; lungs and heart apparently normal; fourth stomach decidedly congested and inflamed; both small and large intestines congested; there were also some localized areas of inflammation in the small intestines; liver, spleen, and pancreas showed no macroscopic lesions.

Tissues taken for microscopic examination: Liver, kidney, stomach, intestines, heart, and lung, all in Zenker's fluid.

CASE 14.

Aged roan cow, owned by Anaconda Copper Mining Company. Animal killed December 1, 1906, by shooting on company's ranch. This cow had been in Anaconda Copper Mining Company's possession since October, 1905; purchased out of Staton's stock; had been on pasture about 4 miles northeast of smelter. General condition fair, but not as good as the Idaho animals; pronounced garlicky odor from nostrils; mucous membrane of trachea red and congested; lungs apparently unaffected; heart, some thickening of endocardium, myocardium apparently unaffected; first three stomachs apparently unaffected, fourth stomach somewhat congested, but not excessively; liver enlarged, showed hypertrophic cirrhosis; spleen pigmented, with several localized areas of induration; small intestines slightly congested; kidneys congested at the cortex; pancreas, adrenals, and bladder showed no macroscopic lesions.

Tissues taken for microscopic examination: Lungs, kidneys, stomach, intestines, spleen, liver, in Zenker's fluid; liver and kidney in Fleming's solution. Samples of liver and kidney were also taken for chemical examination.

CASE 15.

Red heifer, owned by P. Lappin. Animal killed December 3, 1906, on Lappin's ranch by knocking and bleeding. General condition unthrifty, anemic; trachea slightly congested; lung pale, shrunken, but no apparent macroscopic lesion; heart flabby; stomach apparently unaffected; small intestine slightly congested; liver hypertrophied, pale, rather soft in consistency; kidneys decidedly mottled, most pronounced areas of degeneration, atrophy of cortex; adrenals, spleen, pancreas, and bladder showed no macroscopic lesions.

Tissues taken for microscopic examination: Lung, liver, kidney, stomach, heart, spleen, in Zenker's fluid; liver and kidney in Fleming's solution.

CASE 16.

Aged dark-brown horse, owned by L. Leffering. Animal killed on P. Lappin's ranch December 3, 1906, by shooting through the neck and bleeding. General condition unthrifty; pronounced garlicky odor from nostrils; ulcer in right nostril; lungs congested, emphysematous around lower border and atrophic at

tips of lobes; heart hypertrophied; considerable amount of effusion in abdominal cavity; mucous membrane of stomach swollen and inflamed at the pyloric portion; small intestines decidedly congested, particularly in the upper portion; few bots in duodenum; liver congested, enlarged, firm; cortex of kidney very congested, glomeruli prominent; spleen congested, deeply pigmented; adrenals enlarged; bladder apparently unchanged.

Tissues taken for microscopic examination: Lung, liver, kidney, stomach, heart, spleen, in Zenker's fluid; liver and kidney in Fleming's solution; liver and kidney and nasal ulcer in 10 per cent formaldehyde.

Case 17.

Brown filly, owned by Anaconda Copper Mining Company. Animal killed December 4, 1906, on section 16, company's ranch, by shooting and bleeding. General condition fair; pronounced garlicky odor from nostrils; no nasal ulcer; marked gum line; trachea slightly congested; lungs apparently unaffected; pleura thickened; heart normal; mucous membrane of stomach thickened, inflamed, and in a state of chronic catarrh. External examination of intestines revealed the presence of a large aneurism of the anterior mesenteric artery, caused by sclerostomes. On opening the small intestines, the mucous coat was found slightly congested. The cecum contained a large number of sclerostomes and was filled with digested food and a large amount of very fine brownish-black seeds which the animal could not have gotten on the pasture, but were probably administered for medicinal purposes. Liver was slightly sclerotic and enlarged. A moderate amount of congestion was found in the cortical portion of the kidney. Adrenals, pancreas, spleen, and bladder apparently unaffected on macroscopic examination.

Tissues taken for microscopic examination: Lung, liver, kidney, stomach, heart, spleen, aneurism, in Zenker's fluid; aneurism in 10 per cent formaldehyde solution.

Case 18.

Iron-gray horse about 3 years old, owned by Anaconda Copper Mining Company. Animal killed December 4, 1906, on section 16, company's ranch, by shooting and bleeding. General condition good, except some interference with breathing after exercise. Pronounced garlicky odor from nostrils; marked gum line; trachea slightly congested; lungs apparently unaffected; mucous membrane of stomach thickened, in a chronic catarrhal state, covered with mucus; Mucous membrane of the small intestines slightly congested; cecum contained a limited number of sclerostomes and a large amount of fine brownish-black seeds intermingled with digested and macerated food. There was also an aneurism of the mesenteric artery, but not as large as in the preceding case. Liver stained by bile pigment; kidneys slightly congested; adrenals enlarged; pancreas, spleen, and bladder showed no macroscopic lesions.

Tissues taken for microscopic examination: Lung, liver, kidney, stomach, duodenum, heart, all in Zenker's fluid.

Case 19.

Sheep, owned by Deer Lodge Farmers' Association. Animal killed by bleeding on B. Para's ranch, December 5, 1906. General condition good. The animal had been previously examined in November. Marked gum line; mucous membrane of trachea decidedly congested; lung slightly congested; heart flabby; first three stomachs normal; mucous membrane of fourth stomach congested at pyloric orifice; both small and large intestines showed no macroscopic lesions; liver slightly congested; remaining organs showed no macroscopic lesions.

Tissues taken for microscopic examination: Liver, kidney, lung, intestines, stomach, all in Zenker's fluid.

CASE 20.

Gray gelding, owner unknown. Animal broke its leg and was killed by shooting and bleeding on B. Para's ranch, December 5, 1906. General condition unthrifty; trachea congested; lungs congested; stomach inflamed, chronic catarrh; small intestines slightly congested; large intestines contained few sclerostomes; small aneurism of the small mesenteric artery; liver slightly congested; kidneys congested; spleen pigmented and enlarged; pancreas, adrenals, and bladder showed no apparent macroscopic lesions.

Tissues taken for microscopic examination: Lung, liver, kidney, intestines, in Zenker's fluid; aneurism in 10 per cent formaldehyde.

CASE 21.

Young bull, owned by Bart Para. Animal killed on Bliss ranch, December 6, 1906, by shooting and bleeding. General condition unthrifty; trachea slightly congested; lungs and heart apparently normal; mucous membrane of stomach slightly congested; both small and large intestines showed no apparent macroscopic lesions; slight congestion of cortex of kidney; adrenals, spleen, pancreas, and bladder apparently normal.

Tissues taken for microscopic examination: Lung, liver, kidney, stomach, spleen, testicle, in Zenker's fluid.

CASE 22.

Bay mare, owned by Mathews Smith. Autopsied December 7, 1906, about thirty-six hours after spontaneous death. General condition, large animal in good flesh, bruised extensively. Abdomen greatly distended by gases; lung and heart greatly congested; stomach and intestines intensely congested, marked putrefactive changes. The small quantity of intestinal contents present was liquid in consistency. There were also marked traces of scouring on the hind quarters. Kidneys intensely congested, soft, and decomposed; liver congested, bile-stained, and soft; bladder congested; mucous membrane of uterus and vagina congested and edematous.

No tissues were taken for microscopic examination, but samples of stomach, intestines, kidney, and liver were taken for chemical examination.

The organs from two deer, shot by Mr. Cheney Beal on the foothills of Deer Lodge Valley, northeast of the Elliott ranch, were also examined and samples taken for chemical examination. The stomachs, livers, and kidneys were intensely congested and inflamed.

From the 21 autopsies 135 samples were taken. Out of this number 20 samples were selected from the more typical cases for microscopic study and description.

MICROSCOPICAL ANATOMY.

CASE 1.

Slide A.—From mucous membrane of colt's stomach. The thickened and swollen mucous membrane shows no erosion or necrosis. The interglandular capillaries are greatly distended by blood at various points, particularly in the superficial portion of their course. In some places several capillaries are grouped

so closely together that they correspond to petechiæ or hemorrhagic points, which were seen distinctly on macroscopic inspection at the autopsy. The chief and parietal cells show no degenerative changes. At the bottom of the mucosa in the substantia propria or stroma a slight inflammatory round-cell infiltration is present and extends at various points between the gastric glands, but is more abundant around the blood vessels. Such cell infiltrations have been originally described by Virchow as gastro-adenitis arsenicalis parenchymatosa. The muscularis mucosa is slightly thickened, the entire mucosa is greatly hypertrophied and congested, and the walls of the hyperemic blood vessels are thickened. The surface of the organ is coated by a thin layer of mucus, fissured or broken in several places, and is infiltrated by hemorrhages.

Slide B.—Section from cortex of kidney. The walls of the capillaries are thickened and distended by blood. There is also an increase in the supporting connective tissue as well as a proliferation of the connective-tissue cells. The glomeruli are slightly congested. Diapedesis of red blood corpuscles is seen between the proximal and distal convoluted tubules of the labyrinth. Several small hemorrhagic areas are present in the middle of the cortex. The cytoplasm of the renal epithelium lining the convoluted tubules is quite granular, which condition in some parts is sufficient to suggest cloudy swelling. Occasional necrotic areas and vacuolation are present where the change has advanced to a state of fatty degeneration. The karyoplasm is also in varying degrees of degeneration, so slight in some cells as to appear almost normal and taking the staining quite well, while in other cells it has become quite irregular and is in a state of karyorhexis or fragmentation or in a state of karyolysis or dissolution, when it has disappeared either partly, where the nuclei stain poorly, or altogether, when it is impossible to distinguish the nuclei. The vacuolation of the cytoplasm is the turning point from advanced cloudy swelling to fatty degeneration, followed in places by minute necrotic areas which subsequently liquefy, the result of liquefaction necrosis bringing about vacuolation of the cytoplasm.

Slide C.—This is also a section from the kidney. The piece was taken from the side instead of the upper part of the organ and comprises more medullary portions than cortical. The collecting tubules being cut almost at right angle to their course, the congestion in this part of the kidney is even more extensive than in the cortical region. The distended capillaries each form areas smaller in size, but they stand out in greater contrast than in the cortex on account of structural peculiarities of the collecting tubules.

Slide D.—Section of kidney taken from the medulla and cut in the axis of the collecting tubules as far as possible, where near the tip of the renal papillæ the ducts of Beleni are cut transversely. The most notable feature of this preparation is the partial loosening of the epithelium in masses from the support and the absence of degenerative changes, which can be attributed to the straight course of the collecting tubules. The numerous capillaries, however, are somewhat distended, which condition becomes more pronounced as we ascend from the renal papillæ toward the boundary layer, where some of the capillaries assume more the nature of a hemorrhagic area from the close proximity of the vessels than that of mere distended vessels. The connective-tissue cell proliferation in the stroma of the medulla is not as pronounced as between the convoluted tubules of the cortex and in the vicinity of the renal capsule; still there are enough inflammatory cells present to indicate a decided inflammation of the organ.

Slide E.—Section of lung. The pleura is thickened and all the pulmonary capillaries are greatly congested and in some places distended to the point of engorgement, which becomes the characteristic feature of the preparation.

There is a moderate amount of inflammatory cell proliferation in the peribronchial connective tissue, though less pronounced in the interalveolar tissue. Small circumscribed areas of the alveoli are filled with a moderate amount of catarrhal exudate containing a few desquamated pulmonary epithelial cells, but the process is not extensive enough to be of much consequence and is mentioned rather as descriptive evidence of its presence.

Slide F.—Section of liver. The characteristic feature in this section is the hypertrophic cirrhosis with proliferation of bile ducts. The liver lobules, the outlines of which are traced with difficulty in the normal organ, are here well separated from one another by large masses of proliferating young growing connective-tissue cells. This cell proliferation is most conspicuous in the periportal areas, which appear to be the primary and principal seat of the operation of the irritant, brought there from the intestines by the portal circulation. The proliferation of the bile ducts appears also to be the result of action of the same irritant. The cytoplasm of the hepatic cells is not profoundly altered, although some of the cells are quite granular, stain faintly, and stand out in great contrast to the less affected cells that have taken the staining quite well. In many of the liver cells a small amount of pigment is present. A moderate amount of outwandered leucocytes and diapedesis of the red blood corpuscles is present in the vicinity of the capsule of Glisson, extending also for some distance into the interior of the organ, where the corpuscles are aggregated sufficiently dense to form blood areas. There is also a good-sized hemorrhage near the capsule of Glisson. This hemorrhage should not be confounded with a neighboring portal vein which is more extensive than the hemorrhage.

Slide G.—Section of cardiac muscle. The endocardium is considerably thickened. The individual fibers in the myocardium are not materially altered by degeneration, though there is a greater number of connective-tissue cells than is generally found between the cardiac fibers. There is also a moderate amount of leucocytes and diapedesis of red blood corpuscles seen to a better advantage in places where the fibers are cut longitudinally.

CASE 2.

Slide A.—Section of stomach. The mucous membrane shows erosions in three different places where the surface epithelium has been denuded. The cells lining the ducts of the glands are desquamated in many places. The desquamation is not limited to the ducts alone, but involves about one-third of the gland immediately adjacent. The gastric epithelium shows no marked degeneration except an increased granulation of the cytoplasm of the central cells. Many interglandular capillaries are more congested than in the preceding case, while the inflammatory cell proliferation at the bottom of the mucosa is also present in this case, but to a less degree than in the previous one. The submucosa is greatly hypertrophied and all the capillaries are congested. The mucularis and the serous coat are also hypertrophied, but show no other alteration.

Slide B.—Section of kidney comprising both cortex and medulla, stained in picro-fuchsin. The capsule is thickened and is blood stained on the outer surface, where the blood corpuscles tightly adhere and apparently penetrate the outer surface of the capsule. On the inner surface of the capsule the extravasated blood is accumulated in several places and permeated between the uriniferous tubes quite extensively for some distance into the interior of the cortex. The capillaries throughout the cortex are congested, particularly in the vicinity of the Malpighian bodies. All glomeruli are likewise congested, except those situated in the columns of Bertini. Outwandered leucocytes and diapedesis of

the red blood corpuscles and hemorrhagic areas of limited size are present in various places. The connective-tissue cell proliferation present in the stroma is very abundant in the region of the boundary layer and only slightly in evidence in other parts of the kidney. The epithelium lining the proximal and distal convoluted tubules in the labyrinth is granular, degenerated, and desquamated, whereas in the collecting tubules these changes are not so apparent. The medulla of the kidney is also congested, and the congestion is even more disseminated than in the cortex.

Slide D.—Section of liver. The capsule of Glisson is thickened. There is a slight capillary hemorrhage in some of the lobules, also an increase of the interlobular connective tissue, which has contracted and partly distorted the liver lobules, and constitutes the atrophic cirrhosis which is the characteristic lesion in this preparation. The cirrhotic process in this liver differs very materially from that in case 1, where it is hypertrophic in nature, with cell proliferation, whereas in this case, instead of the cells, there are present connective-tissue fibers that have contracted, constituting the atrophic form. A limited amount of fat situated at the periphery of some of the lobules is in the nature of an infiltration rather than a degeneration. The connective-tissue cell proliferation around the portal canals, while present, is very slight. The hepatic cells are quite granular, some are atrophic, while others show an advanced state of cloudy swelling but no vacuolation. The cell nuclei have suffered either fragmentation or dissolution, the karyoplasm staining so faintly that it can not be distinguished from the cytoplasm of the cell. There is also a slight bile pigmentation present in many of the hepatic cells.

Case 3.

Slide A.—Section of stomach. The mucous membrane of the stomach shows two distinct areas of erosions where the surface cells have undergone necrosis, thus forming small cup-shaped depressions, the edges of which are regenerating. The interglandular capillaries are congested, moderate outwandering of leucocytes and diapedesis of the red blood corpuscles are present, and numerous hemorrhagic areas may be seen at various levels of the greatly hypertrophied mucosa. The epithelium lining the ducts, as well as that lining the gastric glands for about one-quarter of its extent adjacent to the ducts, is somewhat degenerated and often desquamated. There are pronounced outwandering of leucocytes and diapedesis of the red blood corpuscles in the submucosa, which is likewise hypertrophied. The remaining coats of the stomach show no decided alteration.

Slide B.—Section of kidney from the medulla cut obliquely to the axis of the uriniferous tubules. The preparation shows an extensive congestion of all the capillaries. Neither degeneration nor desquamation of the renal epithelium is present in this section. (Subsequent examinations of other sections from the cortex of this kidney showed both degeneration and desquamation present in that portion of the organ, but not as pronounced as in case 1.)

Slide D.—Section of liver. The characteristic lesion in this section is the hypertrophic cirrhosis, which is even more pronounced than in case 1. The connective-tissue cell proliferation is so extensive as to outline perfectly nearly every liver lobule. The periportal inflammatory cell proliferation is less extensive than in case 1. The cytoplasm of the majority of the hepatic cells is swollen and granular, this latter condition constituting cloudy swelling, varying in intensity. The karyoplasm has also suffered decided alteration of the chromatin either by fragmentation or by dissolution, which has diminished the staining property of the nucleus. Neither necrosis nor vacuolation has taken place in the cytoplasm of the cells.

CASE 8.

Slide A.—Section of steer's stomach near the pyloric portion. The mucous membrane shows no erosion, and the cells lining the surface have not been detached. The epithelium lining the ducts, as well as that lining almost the entire gastric gland, does not show any pronounced alteration except at the terminal portion of the fundus, where the cytoplasm of the cells is decidedly granular. The mucosa and submucosa are hypertrophied and somewhat congested. The most characteristic feature of this section is the excessive and diffused proliferation of the connective-tissue cells, accumulated in greatest quantity at the bottom of the mucosa and extending along the course of the gastric glands to the surface of nearly every tubule. The proliferating masses of this inflammatory cell infiltration are intermingled with a considerable amount of polynucleated, polymorphonucleated leucocytes and eosinophiles, which are readily distinguished by their staining from the connective-tissue cell proliferation. The muscularis, both circular and longitudinal portions, is slightly hypertrophied, but shows no other alteration. The serous coat appears unaffected.

Slide B.—Section of kidney comprising cortex and medulla. Nearly all the capillaries of the cortex are overdistended by blood; there are also extensive outwandering of leucocytes and diapedesis of the red blood corpuscles between the convoluted tubules of the labyrinth and around and within the capsule of Bowman. There are also several small hemorrhagic areas in different portions of the cortex. The cytoplasm of the renal epithelium in the proximal and distal convoluted tubules is quite granular and in different stages of disintegration. Some of the tubules show very pronounced degeneration and some desquamation. The nuclei of these cells are also in various stages of degeneration, and while some have taken the staining quite well, others are entirely blended with the cytoplasm of the cell. The medulla shows excessive congestion, but no desquamation of the epithelium.

Slide C.—Section of lung. The pleura is thickened. The pulmonary capillaries are distended, but there is no pronounced outwandering of leucocytes and no diapedesis of the red blood corpuscles. A small amount of catarrhal exudate is present in some of the alveoli, but not sufficient to cause any pronounced disturbance. There is some cell proliferation around the bronchial tubes and an increase in the interlobular connective tissue.

Slide E.—Section of heart. The individual cardiac fibers are not perceptibly altered by degeneration, though the capillaries are noticeably distended, a considerable amount of outwandered leucocytes and diapedesis of red blood corpuscles and several circumscribed small hemorrhagic areas are present.

Slide F.—Section of small intestines. The epithelium covering the villi appears unimpaired, that lining Lieberkuhn's glands swollen, decidedly granular but not desquamated. The mucosa as well as the submucosa is considerably hypertrophied, and all the capillaries are distended, indicating a pronounced congestion. The most characteristic feature of this preparation is the excessive diffuse inflammatory cell proliferation, differing very materially from the more compact and well circumscribed cell aggregations of the solitary glands and Pyer's patches. Both the circular and longitudinal muscular coats are hypertrophied and more loosely arranged than normally. The intermuscular plexus of Auerbach is greatly enlarged, and some of the ganglion cells are very granular. One part of the section shows also a well-defined Pyer's patch.

CASE 12.

Slide A.—Section of stomach. There is no erosion or necrosis on the surface of the mucosa, which is greatly hypertrophied and intensely congested, as indicated by the overdistended capillary vessels and severe hemorrhagic areas present in the mucosa, submucosa, and muscularis. The epithelium lining the ducts of the gastric glands is not altered, while that of the parietal and the chief cells is quite granular, degenerated, and desquamated in most of the peptic glands.

Slide B.—Section of kidney comprising cortex and medulla. The capsule is slightly thickened and adherent. All the capillaries are congested, especially those of the glomeruli. There is a considerable number of leucocytes, decided diapedesis between the convoluted tubules of the labyrinth, also several large hemorrhagic areas in several portions of the cortex. The medulla is even more congested than the cortex. The renal epithelium lining the proximal and distal convoluted tubules is granular and degenerated, but shows no marked necrosis, nor is it desquamated.

Slide C.—Section of lung. There is an excessive congestion of the pulmonary capillaries, accompanied by outwandered leucocytes and diapedesis of red blood corpuscles and numerous small hemorrhagic areas. The interalveolar, peribronchial, and interstitial connective tissues show a moderate amount of cell proliferation. There is also a small amount of catarrhal exudate in the infundibuli, but no extensive desquamation of the pulmonary epithelium.

In addition to these slides described above, many slides prepared by Dr. D. E. Salmon were examined by the writer, as well as a number of slides prepared under the direction of Dr. V. A. Moore from animals experimentally poisoned.

CONCLUSIONS FROM MICROSCOPIC EXAMINATIONS.

The microscopic changes in these tissues are as characteristic as the post-mortem appearances in any smelter district, and a careful study of the preparations, supported in most instances by a chemical analysis, can be summed up as follows: (1) Vascular changes, (2) epithelial changes, (3) connective-tissue cell proliferation.

1. Vascular changes, which varied from slight dilatation, fullness, and distention of the capillaries in the stomach, intestines, kidneys, liver, lungs, and heart to more pronounced conditions accompanied by outwandering of leucocytes, diapedesis of red blood corpuscles, and in some instances hemorrhagic areas varying in size and corresponding to the petechiæ seen on macroscopic inspection. The pronounced congestion of the gastro-intestinal tract, but particularly of the stomach, is evidently due to the action of an irritant that has brought about similar conditions in other organs concerned in elimination and metabolism, namely, the kidneys, liver, and lungs. The degree of these changes varies in intensity—acute, in Doctor Moore's experimental cases of arsenic poisoning, subacute and chronic in Doctor Salmon's cases and in those described above. Chemical analysis proved the irritant to be arsenic.

2. Epithelial changes vary from a slight granular condition of the cytoplasm to a marked degeneration of the cytoplasm and from a breaking down and vacuolation to a destruction and loss of cell substance, which in the advanced stages of metabolism is the forerunner of fatty degeneration. It is also accompanied by changes in the karyoplasm, as fragmentation or dissolution of the chromatin. This is demonstrable by staining; when the chromatin is but slightly affected the nuclei take the staining quite well, but stain fainter in proportion to the dissolution of the chromatin and become finally invisible by the completion of the process of karyolysis, when the karyoplasm apparently has blended with the cytoplasm. These changes are most pronounced in the organs of metabolic activity—the liver and kidneys—but may also be observed to a less degree in the gastric cells. There is also desquamation of the epithelium in the proximal and distal convoluted tubules, and to a less degree in the collecting tubules of the kidney and the respiratory epithelium of the air cells.

3. The connective-tissue cell proliferation or multiplication, which can only be the result of an irritant, inflammatory in character, is well pronounced in the mucous membrane in the stomach, the name of gastro-adenitis parenchymatosa arsenicalis having been suggested by Virchow for similar cell proliferations in the stomach. The cell proliferation is present at the bottom of the mucosa and frequently extends toward the surface, compressing the fundus and the gastric glands. It is most marked in the vicinity of the blood vessels, but extends as a loose accumulation throughout the mucosa, differing very materially from the denser and more circumscribed so-called lenticular glands which are the lymph nodes normally present in the mucosa of the stomach and the solitary glands of the intestines. This cell proliferation was not limited to the gastro-intestinal tract, but was present also in the cortex of the kidney between the convoluted tubules, in the liver in the periportal areas, and in the lung around the bronchi in the peribronchial tissue.

GENERAL SUMMARY.

1. The Washoe smelter near Anaconda, Mont., is situated on a high hill towering above the Deer Lodge Valley, which extends 30 miles in length and 4 to 6 miles in breadth. The smelter roasts daily from 8,000 to 10,000 tons of ore which is quite rich in arsenic. The dense volume of smoke containing smelter fumes and flue dust rises high under favorable atmospheric conditions and can be traced for over 16 miles as a continuous cloud to its origin, the huge smokestack, 300 feet high and 30 feet wide at the orifice. Prevailing aerial currents direct the course of the smoke to various parts of the valley, the foothills, and mountains. The great heat at which the fumes

and flue dust are generated, aided by the forced draft, is responsible for the excessive velocity of the contaminating particles, which, after cooling in the air, are precipitated and deposited not only on the grasses of the valley, but also on the vegetation of the foothills and the foliage of the surrounding forests. The emanations of flue dust from the smelter contain from 22 to 30 tons of arsenic every twenty-four hours.

2. Damage to grasses and forests can be detected even by an untrained casual observer, and thorough investigation by expert foresters and chemists has proved the existence of extensive damage. The soil, when irrigated by water that is contaminated by the waste products of the smelter which reach some of the streams, suffers deterioration of its fertility, as is shown by the diminution of the crops.

3. The chemical analyses of the grasses, hay, and soil by Dr. J. K. Haywood and by Professors Harkins and Swain show the presence of a considerable amount of arsenic. According to Harkins and Swain, arsenic is found not only in the above-mentioned substances, but also in the hair, stomach, intestines, liver, pancreas, spleen, brain, spinal cord, thyroid gland, muscles, lungs, bones, heart, bladder, salivary glands, fat, adrenals, and blood of the animals in that vicinity. This includes not only all the vital organs, but practically every structure in the animal economy.

4. Animals pasturing in Deer Lodge Valley become unthrifty and suffer from digestive disturbances and derangements of the organs concerned in the assimilation of food, and death frequently occurs in the endeavor to eliminate the irritating substances from their systems. Those that survive are rendered worthless for breeding purposes. Cattle intended for beef are too lean to be marketable, while horses are rendered unfit for work or driving purposes.

5. The pathologic findings on post-mortem examination show unmistakable lesions of chronic catarrhal inflammation of the stomach, intestines, lungs, and kidneys. The microscopic preparations demonstrate conclusively the presence of a pronounced irritant, which has operated on all organs pertaining to the metabolism and assimilation of food, as well as those concerned in the elimination of waste products, being characterized by an inflammatory cell proliferation in the mucous membrane of the stomach and intestines, the portal areas of the liver, the peribronchial connective tissue of the lung, and the interstitial connective tissue of the kidneys. These cell infiltrations or proliferations can be the result only of an irritant, which on chemical analysis has proven to be arsenic.

6. From the foregoing we conclude that smelter fumes and flue dust, laden as they are with highly dynamized mineral elements, form a most certain means of distributing such elements over regions

of greater or less extent; that where smelter smoke and flue dust contain arsenic the amount of that toxic mineral distributed in the course of a day reaches many tons; that careful investigations of the region affected by smelter smoke reveal a steadily growing diminution in the quantity and quality of crops and vegetation of all kinds; that the same kind of deterioration is noticeable in the live-stock industry, large numbers of horses and cattle and other stock dying, and those that continue to live manifesting lowered vitality, depraved nutrition, and derangements of the breeding function even to sterility; that both on the Continent of Europe, and particularly in the Deer Lodge Valley of this country, where the writer's investigations were conducted, the clinical symptoms of animals thus affected coincide with those known to science as symptoms of arsenical poisoning; that the post-mortem findings in animals that have died or in affected animals purposely killed confirm such diagnosis; that the histologic examinations of the tissues of such animals abundantly establish the accuracy of this diagnosis; that feeding experiments with known quantities of arsenic and the experimental local application of arsenic resulted in the production of symptoms and lesions identical with those found in affected animals; that expert chemical investigations, not only of the grasses, hay, soil, etc., but also of all animal tissues, demonstrate the presence of toxic quantities of arsenic; that finally we have in the Deer Lodge Valley an industry which under present conditions is wholly incompatible with agriculture, destructive alike of animal and vegetable life.

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THE PREVENTION OF LOSSES AMONG SHEEP FROM STOMACH WORMS (HÆMONCHUS CONTORTUS).

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INTRODUCTION.

The important problem of how to prevent losses among sheep from stomach worms is one for which, apparently, no solution that meets the wants of the practical sheep raiser has yet been discovered. After a preliminary investigation of the question it was hoped that such a solution might be reached, but in the light of further study of the life history of the stomach worm, combined with various experiments on sheep and lambs, the writer is less sanguine in regard to the matter.

Before proceeding to a consideration of measures which may be taken to avoid the injurious effects of stomach worms it may be well to discuss briefly some of the points relative to the behavior and life history of these parasites which have been brought out by investigation and experiment.

It is commonly noted that lambs are more severely affected by stomach worms than older sheep. The former become pale, thin, and weak, and finally die, or continue for a long time in poor condition and fail to grow as they should, while the adult sheep of the flock may remain in apparently good health. In such cases, however, it will be found if some of the older sheep are killed and examined that they as well as the lambs are more or less heavily infested with stomach worms. The reason, therefore, that the lambs are affected and the adult sheep are not, is because the latter possess a tolerance toward stomach worms not shared in an equal degree by the lambs.

The injurious action of stomach worms may be attributed to two things: First, the loss of blood abstracted by the parasites and the loss of nutritive materials which may be absorbed by the parasites from the alimentary fluids, and, second, the destruction of red corpuscles by a poisonous substance secreted by the parasites which is absorbed into the blood. Evidently the older, stronger, and larger sheep are better able than the lambs to withstand the losses of blood and nutritive materials and can better endure the loss due to the destruction of red corpuscles. Furthermore, there may be substances present in the blood of adult sheep tending to neutralize the poisonous matter produced by the parasites that are absent from the blood of the lambs,

or that, if present, occur in smaller quantities. It is barely possible that some means of artificially producing in lambs an immunity against the evil effects of stomach worms may be devised, but at the present time this is only a matter for speculation and experimental research. Our present knowledge of the stomach worms leads us to direct our efforts toward bringing about freedom from infection, or, as the next best thing, reducing the amount of infection to a minimum and keeping it there.

LIFE HISTORY OF THE STOMACH WORM.

In the adult sexual stage stomach worms are able to live and carry out their reproductive functions only in the alimentary canal of sheep or other ruminants, occurring in the largest numbers in the fourth stomach. Each female produces thousands of eggs of microscopic size which do not develop into adult worms in the body of the host in which they are deposited, but, without hatching, pass out of the intestine in the feces. In a few hours, days, or weeks, according as the temperature is high or low, these eggs, if they are not killed by dryness or freezing—either of which is fatal to them—hatch out, and the tiny embryonic stomach worms then develop to what may be termed the final larval stage, or infectious stage. This later development likewise requires days or weeks, according to the temperature, and until the embryos have reached the infectious stage they appear to be fully as susceptible to freezing and drying as the eggs. Having reached the infectious stage, however, the worms are able to withstand long periods of dryness and severe cold, though some of them succumb comparatively early.

In the infectious stage the young worms are very active in the presence of moisture, and rapidly crawl up blades of grass and other objects whenever the relative humidity of the air is at a maximum, provided the temperature is above 40° F. or thereabout; below this temperature they are inactive. A decrease in the relative humidity, with the consequent evaporation of the moisture from the surface of grass blades and other objects, stops the migrations of the worms, and they become quiescent and remain in a condition of suspended animation wherever they happen to be at the time. During the next period of wet weather, dew, rain, or fog, they again become active and climb still higher on the grass. This crawling up grass blades is evidently most advantageous to the worm, as it thereby gets into a position from which it is much more likely to attain its final abode within the stomach of a sheep or cow than if it stayed down on the ground. When swallowed by a sheep or other ruminant, the embryonic stomach worm, if it has reached its final larval stage, whether active at the time or in a state of suspended animation, continues

its development and in the course of two or three weeks has reached maturity.

The length of life of individual worms in the stomach has not been determined. We have kept infested sheep in pens with board floors which were kept clean by sweeping and frequent scrubbing, feeding the sheep from raised racks and supplying water in a trough which was frequently cleaned, for varying periods up to a maximum of nineteen months, and found them still infested. As the possibility of reinfection by larval worms developing from eggs passed in the feces of these sheep was not entirely removed, though greatly minimized, the results obtained do not necessarily indicate that the worms present at the end of the period of observation were all present when the experiment was begun. The experiment, however, while it proves nothing as to the length of life of the adult stomach worm, demonstrates the futility of attempting to rid sheep entirely of stomach worms by simply keeping them away from pasture.

TREATMENT OF PASTURES.

The maximum period during which the larval stomach worms are able to survive on pastures is not definitely known, but it has been found that pastures on which infested sheep had grazed were apparently still infectious after a lapse of nearly eight months, namely, from October 25, when the infected sheep were removed, to June 16, when the pastures were tested by placing in them some lambs which had been raised under special precautions to avoid previous infection. In cultures made September 14, 1906, from the feces of an infested sheep and kept thereafter in the laboratory, most of the larvæ were dead but some were still alive, though very sluggish, on June 5, 1907, nearly nine months later. Cultures in which the embryos were allowed to develop to the final larval stage, after which they were kept in cold storage at temperatures below freezing—in some cases as low as 12° F.—still contained some living embryos after two or three months, while in other cultures eggs and embryos not yet developed to the final larval stage were killed within a few hours when exposed to temperatures below freezing. These experiments show that pastures may remain infected for several months after sheep are removed from them, and that the infection is not destroyed by cold weather. They also show that during a winter with more or less freezing weather there will be little or no increase in the amount of infection in pastures occupied by infested sheep. The eggs passed in the feces of the sheep will either be killed at once by freezing, or, on account of low temperatures above freezing, will remain dormant or develop so slowly that they are killed later by frost before they have reached the final

larval stage, which is resistant to cold. At the same time, while the infection of pastures may not be increased during the winter, the infestation of the sheep may be added to by their picking up from time to time larval worms which, prior to the beginning of cold weather, had already developed to the stage in which they are able to withstand freezing.

If sheep, goats, and cattle are kept out of a pasture for a year, it is fair to assume, upon the basis of our present knowledge, that all, or practically all, larval stomach worms will have died within this time. There is also little doubt that the period required for practically accomplishing disinfection of a pasture may be considerably shortened by plowing it up and placing it under cultivation. There are thus two ways by which a pasture may be disinfected, one by excluding sheep or other ruminants for at least a year, and the other by turning the pasture into a cultivated field. In view of the fact that any sheep which may be placed on disinfected fields or pastures will probably not be entirely free from infestation, it is not of much consequence whether every larval stomach worm in the pastures is dead or not. The approximation to this point which is attained by vacating pastures for a year or by plowing them up is sufficient for practical purposes.

METHODS OF PREVENTING THE DISEASE.

Taking up the question of preventing stomach-worm infection, it appears that at the present time the only method of handling lambs born of infested ewes that can be guaranteed to keep the lambs free from stomach worms is a method which is so impracticable that it is not likely to come into general use. As soon as born the lambs would have to be taken away from their mothers and raised by hand, never allowed to suckle, and be kept by themselves in places not previously occupied by sheep, cattle, or goats, all of which being subject to stomach worms are liable to leave infection wherever they happen to have been, which, it has been noted, may persist for many months. The possibility of the embryos of stomach worms reaching these places by drainage from infected areas, in hay cut from infected meadows, or in barnyard manure used for fertilizer, would also have to be excluded. Furthermore, the milk fed to these lambs, whether from sheep, goats, or cattle, would have to be pasteurized or sterilized in order to avoid the possibility of infection from this source, as some of the tiny embryos of stomach worms which might be present on the skin, wool, or hair of the animal from which the milk is drawn would be very likely to get into the milk during the process of milking and thus ultimately find their way into the stomachs of the lambs. Simple filtration of the milk would not insure the removal of the worms. The experiment of filtering liquids containing embryonic stomach

worms has been tried, using filter paper of the kind commonly used in laboratories for ordinary filtration, with the result that the worms readily passed through the filter.

THE BARE-LOT METHOD.

Methods of preventing stomach-worm infection less stringent than this have been tried with imperfect results. In the bare-lot method of raising lambs, devised by Dalrymple, the ewes and lambs are kept in an inclosure as free from vegetation as it can be kept, and are fed and watered from raised racks and troughs. Dalrymple found that when this method was used the lambs did not escape infection, and we have had similar experience.

PASTURE ROTATION.

In 1908 at the Experiment Station of the Bureau of Animal Industry near Washington, ten inclosures were constructed in a large field which had not been occupied by sheep or other ruminants for many years. Into inclosure No. 1 were placed a number of ewes and lambs which from the time the latter were born had been kept in separate pens except when turned together at intervals into another pen in order to enable the lambs to suckle, this pen being cleaned after each suckling period.

Prior experiments had indicated that the eggs and newly hatched embryos of the stomach worm would not develop to maturity if swallowed by sheep, and that the embryos must first develop to the final larval stage before they are able to complete their development when swallowed. In view of the fact that more or less time is required for the development from the egg stage which is found in the fresh feces of infested sheep to the final larval stage in which the young worms are ready to be swallowed, it was thought that the lambs might be kept for a time with the ewes in inclosure No. 1 without danger of infection, the danger point being reached when the sheep had been in this inclosure long enough for embryos to develop to the infectious stage from eggs in the feces of the infested ewes. In order to determine when the danger point would be approached cultures were made from the feces of an infested sheep two days before the ewes and lambs were placed in inclosure No. 1.

These cultures were kept outdoors near the inclosures and examined from day to day, other similar cultures being made at intervals of two to three days. As soon as it was found that the stomach-worm eggs present in any of the cultures had hatched and that the embryos had developed to the final larval stage, the lambs and ewes were moved to inclosure No. 2 in order to avoid infection with embryos in the in-

fectious stage, which the test cultures indicated would appear in this stage in inclosure No. 1 a couple of days later.

When the sheep and lambs were moved to inclosure No. 2, test cultures were again used as a guide to determine when the animals should be moved to inclosure No. 3, and so on throughout the entire series, the lambs alone finally being placed in inclosure No. 10. When the lambs were killed and examined after they had been in this inclosure about six months—namely, from July to December—some of them were found to be infested with stomach worms.

The infection of the lambs was evidently due to one or both of two things, namely, they became infected from larval stomach worms on the skin and wool of the ewes, whence the parasites were taken into the mouth by the lambs while suckling, or they became infected from worms which developed to the infectious stage in the various inclosures more rapidly than the test culture indicated. In either case it is clear that during the summer lambs can not be entirely protected from infection if kept with infested ewes, even though the flock be placed on fresh pasture at intervals much shorter than would be possible under practical conditions. In the experiment the sheep averaged less than nine days in each inclosure. Relatively few embryos in the test cultures had developed to the infectious stage when the sheep were changed from one inclosure to the next, the development of the majority proceeding much more slowly; but as it was desired in this experiment to keep on the safe side the sheep were moved as soon as the first appearance of embryos in the final larval stage was noted in the cultures. Even though the periods during which the sheep remained in the various inclosures had been lengthened to correspond to the periods required for larvæ in the infectious stage to become abundant in the cultures, the changes would still have been more frequent than would be practically possible, owing to the large number of clean pastures that would be required.

THE SUCKLING-PEN METHOD.

Dalrymple's plan of having a special suckling pen has also failed to prevent entirely stomach-worm infection in lambs from infested mothers. In the latest experiment with this method which has been carried out in this Bureau the ewes and lambs were placed in two small pastures which were free from infection at the beginning of the experiment, not having been occupied by sheep or other ruminants for a period of several years, the lambs occupying one pasture and the ewes the other. Until the lambs were weaned they were allowed with the ewes at frequent intervals for suckling in a small, bare pen from which all droppings were removed after each period of occupancy. After weaning, the lambs remained in the pasture which they had occupied before until some months later, when they

were killed and examined. Most of them were free from stomach worms, but in some the parasites were present in small numbers.

In earlier experiments the suckling-pen method gave more favorable results, and the writer was led to believe that it might be of some practical use. Since it can not be depended upon absolutely to prevent infection in lambs, as shown by the latest experiment, it is probably not of much practical value. It is not, however, a very troublesome method, as the ewes and lambs soon learn their way back to their proper pastures, and are easily separated after each suckling period. A noninfected pasture is required for the lambs, and since this pasture would become more or less infected as a result of the failure to prevent absolutely the infection of the lambs, it becomes necessary to employ a different pasture for the next crop of lambs, using the same pasture only in alternate years and excluding all ruminants from it in the interim in order to allow any infection which may be present to die out. However, fields adjacent to the ewe pasture might be utilized temporarily as pastures for the lambs and the necessity of maintaining two permanent lamb pastures thus avoided.

The failure of this method to prevent infection entirely is probably due to a circumstance already mentioned, namely, the more or less common occurrence of larval stomach worms upon the skin and wool of the ewes, whence they may sometimes be taken into the mouth of the lambs while suckling and be swallowed.

Inasmuch as there is no known method of handling lambs from infested mothers so as to avoid absolutely stomach-worm infection, with the exception of that in which the lambs are raised by hand, we must be content with reducing the amount of infection as much as possible and keeping the sheep and lambs in as good physical condition as practicable, so that they may be better able to tolerate the parasites from which they can not escape. In some cases it may be possible to employ the suckling-pen method to advantage in spite of its apparent impracticability. As to schemes for avoiding infection by the rotation of pastures, it is evident that a rotation plan, in which an attempt is made to keep pace with the development of the embryonic stomach worms by moving the sheep from one pasture to another before embryos hatching from eggs passed in the feces of infested members of the flock have developed to the infectious stage, is out of the question.

COMBINED PASTURE ROTATION AND MEDICINAL TREATMENT.

Recognizing the impracticability of moving sheep from one pasture to another frequently enough to avoid entirely the infection which develops in the pastures, we may next consider a plan for reducing infection by a combination of occasional rotation and

medicinal treatment. In following this plan some losses may occur during the first year or two unless noninfected pastures or fields are available to start with, but thereafter there should be no losses whatever.

This plan may be inaugurated at any time of the year. Supposing that it is to be begun just after lambing, say in March, it is advised that all of the sheep except the lambs be given a preliminary treatment with bluestone, coal-tar creosote, or gasoline, in accordance with the directions given in Circular 102 of the Bureau of Animal Industry. Any cattle or goats that may be on the farm must either be treated in the same manner as the sheep, being dosed for worms and moved from pasture to pasture in company with the sheep, or else be kept strictly apart from the latter in pastures of their own.

After the preliminary treatment, which will destroy a large proportion of the stomach worms that may be present, the sheep, lambs, and all other ruminants are removed to a pasture or field which may be termed pasture No. 1. Preferably this should be a pasture which is free from infection, but if such a pasture is not available, use an infected pasture, and some time in the summer, say the 1st of July, give the entire flock, lambs and all, another course of treatment and move them to a second pasture. The 1st of November another treatment for stomach worms is given, and the animals are moved to pasture No. 3, where they remain until the 1st of March. After this first year's treatment the medicine is given only in the fall, just before the sheep and cattle are moved to the pasture in which they spend the winter. On the 1st of March of the second year they are moved to pasture No. 4, then on the 1st of July to pasture No. 1, from which since July 1 of the preceding year all ruminants have been excluded, but which meanwhile may have been used if desired for live stock not subject to stomach worms, such as horses, mules, or hogs. November 1 the sheep and cattle, after being dosed for worms, are moved to pasture No. 2, from which, as in the case of pasture No. 1, all ruminants have been excluded since the corresponding date of the year before. Then in March pasture No. 3 is occupied again, and so on, from pasture to pasture in regular rotation.

By utilizing the pastures for other live stock during the periods that ruminants are excluded, the land included in the rotation scheme may be made use of more or less continuously. In lieu of some of the pastures, fields might be planted with suitable crops, and made to serve temporarily as pastures, and employed for other agricultural purposes, if desired, when not in use as pastures.

It is very probable, particularly in the case of badly infested flocks and farms, that the foregoing plan will at first fail to prevent entirely the loss of lambs from stomach worms. The flock should be watched closely, and if any of the lambs present symptoms of stomach

worms they should receive proper medicinal treatment. The pastures must not be heavily stocked, especially at first. The more numerous the sheep relative to the size of the pasture, the more heavily infested will the pasture become, and with close grazing the sheep are not only liable to pick up greater numbers of larval stomach worms, but also, unless auxiliary feeding is practiced, may not receive a sufficient quantity of food, and thus be less able to endure parasitic infection. As salt acts to a certain extent as a preventive against stomach worms, as well as being a necessary element in the diet of ruminants, it should be supplied to the sheep in liberal quantities. If possible the use of wet, low-lying pastures should be avoided, or this condition corrected by proper drainage.

The plan which has been outlined above may be variously modified. For example, in a climate with a cold winter season the same pasture could, if desired, be utilized every year as a winter pasture. The sheep would not be placed in this pasture until winter had set in, and would be removed again just before spring began. As already noted, any stomach-worm eggs passed in the feces of the sheep during the winter would either be killed immediately by exposure to freezing weather, or on account of the prevailing low temperature lie dormant or develop slowly with the practical certainty of being killed by freezing on some later occasion before they had reached the infectious stage. The order of rotation in this case would be as follows: Pasture No. 1 until July, pasture No. 2 until winter begins, then to pasture No. 3 (the winter pasture), then at the end of winter to pasture No. 4, then in July to pasture No. 1, then to the winter pasture (No. 3), then to pasture No. 2, etc.

FEEDING TOBACCO.

There has been considerable discussion recently in various live-stock and agricultural journals concerning the feeding of tobacco to sheep as a remedial measure against stomach worms. I will, therefore, in conclusion, briefly refer to some experimental work along this line conducted at the Experiment Station of this Bureau.

In June, 1908, a flock of sheep and lambs, in which stomach worms were known to be present, were separated into three lots with 5 lambs and 7 or 8 full-grown sheep in each, and placed in three similar small pastures. Lot 1 was fed leaf tobacco grown in Maryland, lot 2 tobacco cuttings obtained from a cigar factory, while lot 3 was fed no tobacco at all. Some difficulty was experienced in getting the sheep in lot 2 to eat the cuttings, and they finally had to be started on the leaf, afterwards changing to the cuttings, so that it was not until late in July that they really began to consume the cuttings. By the middle of August the sheep in each of lots 1 and 2 were consuming

10 ounces of tobacco every two days, an average per head of a little over two-thirds of an ounce every forty-eight hours. This represented the maximum which they would eat, and the feeding of this quantity every forty-eight hours was continued until early in December. There was no noticeable difference in the condition of the sheep in the three lots, which remained fairly good throughout the experiment. One lamb in the lot which was not fed tobacco died in July from unknown causes, no post-mortem examination being possible as the carcass was devoured by buzzards before the death of the animal was discovered. In the latter part of December and the early part of January the lambs and some of the ewes were killed and examined, with the result that stomach worms were found to be present in all three lots. In most cases there were only a few, but in one lamb several thousand stomach worms were found. Strangely enough this was a lamb from one of the lots which had been fed tobacco.

The conclusion reached in this experiment is that the feeding of tobacco had no noticeable effect either upon the stomach worms or upon the sheep. The results obtained can not be considered decisive, but they suggest the possibility that the favorable reports which have been made relative to tobacco as a remedy for stomach worms have been based on coincidences, the good results observed in such instances having been due to some other cause than the tobacco. In fact it has been noted that some sheep raisers who have tried tobacco have reported it a failure. At the present time, therefore, tobacco must be considered a remedy of doubtful efficiency so far as stomach worms are concerned.

MALTA FEVER AND THE MALTESE GOAT IMPORTATION.

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AND

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PRELIMINARY REMARKS.

A gradually increasing interest has been manifested during the past few years in the milch-goat industry, and numerous requests for information on this subject are constantly being received by the Bureau of Animal Industry. These requests have come chiefly from physicians who believe in the value of goat's milk for invalids and children, and from people who have either read of the economy of goat keeping or been raised in foreign countries where the milk of goats is such a valuable asset. For instance, milch goats are particularly adapted to the requirements of the peasant class in Italy, Spain, Switzerland, Germany, Austria, and other countries, and it is because the milk of the goat is furnished cheaply and compares favorably with the quality of cow's milk that the milch goat recommends itself to those people in this country who can not afford to keep a cow.

The common American or Spanish goat has been kept for milk production in the United States for a long time, especially in certain States with Italian colonies and in several of the Southern and Southwestern States, but the number of such milch goats is known to be comparatively small. In fact, it was this scarcity of milch goats, and the desire of the Bureau to secure a herd of clean, healthy, hardy milch animals especially for the purpose of serving as foundation stock to supply those interested in the building up of a milch-goat industry in this country, that caused Dr. D. E. Salmon, then Chief of the Bureau of Animal Industry, to make an importation of milch goats from Europe, where this industry is an important and profitable interest. The late Mr. George F. Thompson, who had spent considerable time in studying the different species of these animals, was detailed to make this importation. After visiting several districts in Europe, he finally turned his attention to the Maltese goat and soon became convinced that this was a valuable breed and should be introduced into the United States. These goats are native to the Island of Malta in the Mediterranean Sea, and are also bred to a less extent on the rock of Gibraltar, having been introduced there from Malta.

CHARACTERISTICS OF THE MALTESE GOAT.

For years the Maltese goat has been regarded by those who are familiar with the goat industry as a superior animal, not only on account of its milk production, but also as a prolific breeder. The peculiar semitropical climate of Malta must be responsible for this condition, for the pasturage is very scant; but the goats, which are driven out into the streets two or three times a day, seem to find nourishment in places where a cow would slowly starve to death. The population of Malta, numbering about 203,000 people, are almost solely dependent for milk upon the goat, although a few cows are kept and some condensed milk is imported.

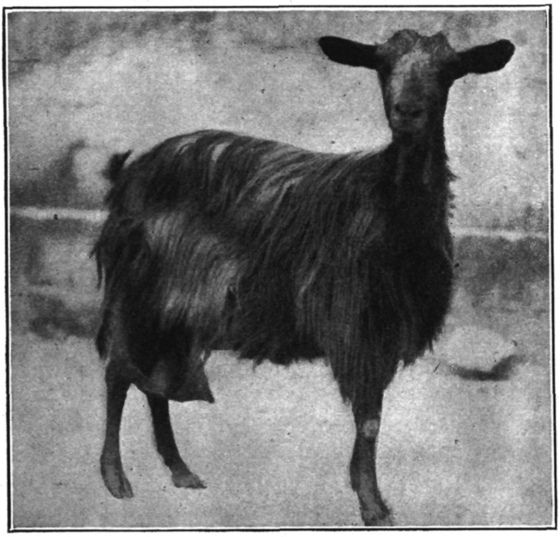


FIG. 36.—A good type of Maltese milch goat.

There is only one breed of goats on the island, although the hair of some is short while in others it is long. They are of all colors, but brown predominates. Quite a number of these animals have horns, but the majority are hornless. The goats are relatively small, the average height being about 2 feet 6 inches and the weight generally ranging from 80 to 90 pounds.

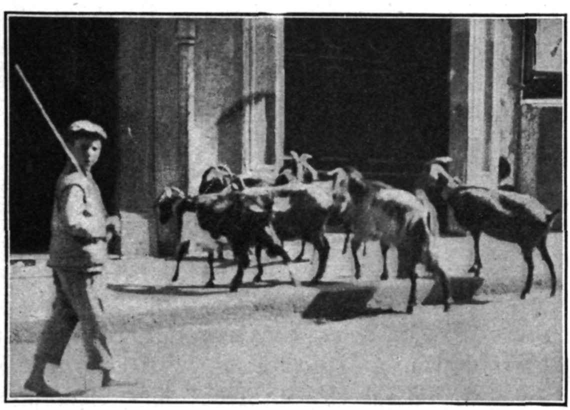


FIG. 37.—Herd of Maltese goats being driven from house to house for sale of milk.

The principal characteristic and main breed peculiarity of the Maltese goats are their very long pendulous ears and very large low-hanging udder with two well-developed teats. In animals above 4 years of age the udder will almost touch the ground as the goat walks, and one with a full udder of this kind may occasionally be

seen moving after the fashion of a kangaroo, carrying the udder forward with her hind legs.

A herd will average 3 to 4 pints of milk per head a day, while some of the best milch animals will secrete a much larger quantity. Mr. Thompson had several of these goats milked regularly under his direction, and it appeared that the average production during the period of lactation of nine months was over 2 quarts daily. Two of the goats gave 4 quarts each, while several others which did not weigh 75 pounds gave only a slightly less quantity.

FIG. 38.—Native method of milking Maltese goat.

In Malta these goats are kept in small herds of from 4 to 35, and one "goatherd," usually the owner, has charge of each herd. The animals are driven along the streets and milked directly into the pails of the customers at the doors of the homes where the milk is desired. The milk is purchased only in small quantities as required, since the goats make two or three trips daily. The goatherd stoops behind the goat to draw the milk, and while the position appears awkward, it is the only one that can be assumed with comfort to the animal and convenience to the one who milks.

HIGH QUALITY OF THE MILK.

The chemical analysis of the milk from six different animals varied as follows:

Specific gravity at 15° C		1.033 to 1.036
Fat	per cent	4.5 to 5.3
Protein	do	3.4 to 3.8
Lactose	do	4.2 to 4.6
Ash	do	.62 to .69
Water	do	83.8 to 85.6
Total solids	do	13.9 to 14.3

The high percentage of fat in goat's milk, together with the fact that it seems to be more easily digested than cow's milk, would probably give to it advantages over ordinary milk for use in the sick room and in the nursery. This essential excellence of goat's milk is not a matter of novelty to many persons, and it ought to meet with early recognition by the people in general. But it is not to be sup-

posed that the goat's milk is destined to supersede that of the cow, especially for the supply of large cities, although there are undoubtedly numerous instances in which the family supply of milk, particularly for invalids and children, can be drawn from the goat to better advantage than from the cow.

THE IMPORTATION OF MALTESE GOATS TO THE UNITED STATES.

As before stated, the Department of Agriculture, recognizing the need of a milch-goat industry in the United States and the excellent milk-producing qualities of the Maltese goats, undertook to obtain an experimental herd of the best animals that could be secured on the Island of Malta. It was the intention to place these animals at the Storrs (Conn.) Agricultural Experiment Station and at the Maryland Agricultural Experiment Station at College Park, where in cooperation with the authorities at these stations the Bureau would conduct experiments to determine their adaptability to climatic and other conditions in this country, and to ascertain the value of their milk, particularly in the manufacture of cheese and as a food for the sick.

In the early summer of 1905 Mr. Thompson proceeded to the Island of Malta for the purpose of collecting the herd. He remained on the island several weeks studying the native methods of handling the animals, during which time he collected a herd of 61 nannies, many of which were prize animals and unusually good milkers, and 4 billies. With these animals and three goatherds he left Malta for Antwerp on August 19, 1905. At Antwerp the goats were unloaded and kept at the quarantine station for five days, when on September 7 they were reembarked for New York. Upon their arrival in the United States on September 23 they were immediately taken to the quarantine station of the Bureau of Animal Industry at Athenia, N. J.

HISTORY OF VOYAGE FROM MALTA TO THE UNITED STATES AND OF PERSONS WHO DRANK THE MILK.

The goats were taken aboard the steamship *Joshua Nicholson* at Malta on August 19, 1905. The ship was on the way from Egypt to London and stopped at Malta only a few hours, none of the crew going ashore. The crew consisted of four officers and nineteen men, in addition to whom Mr. Thompson and the three goatherds were the only passengers. During the voyage to Antwerp, which lasted until September 2, everyone on board used the milk from the goats. At Antwerp eleven of the crew left the ship, and the movements of all of this number remain unknown except one, who went to the hospital with a hernia. The captain later stated that three of this number were under treatment in a hospital in Antwerp with symptoms simi-

lar to Malta fever, but this was not proved. The twelve remaining members of the crew proceeded with the ship to London after a two-weeks' stay in Antwerp. Eight of these men subsequently, in the course of a few weeks, developed Malta fever. The four who escaped included the second mate, the cabin boy, and two engineers. The former two drank very little of the milk because it did not seem to agree with them. The two engineers drank the milk regularly but always boiled it previous to use. Of the eight who became ill all showed similar symptoms which were identical with those of Malta fever, and the blood of five of the patients gave a positive agglutination reaction with *Micrococcus melitensis.* The blood of the other three was not tested. While the goats were at the quarantine station in Antwerp their milk was consumed by a number of other persons, but probably not in large quantity by any single individual. None of these persons became affected with Malta fever so far as is known.

The goats were reembarked in Antwerp on the steamship *St. Andrew* on September 7, 1905, arriving at New York on September 23. The crew of this ship consisted of 30 officers and men, in addition to whom there were 30 cattlemen aboard besides Mr. Thompson and the 3 goatherds. Those aboard consumed the milk, not having heard of the illness among the crew of the *Joshua Nicholson.* The history of the cattlemen after their arrival in the United States is unknown, but all of the crew remained healthy. In this case it is probable the amount of milk consumed by any one person was small, as there were 64 to be supplied instead of 27, as in the other ship, and the goats had noticeably fallen off in their milk since leaving Malta. After the arrival of the goats in America a score or more of persons tasted the milk, but only two persons drank it in any quantity.

One of these, Mr. Thompson, who doubted the idea of Malta fever being conveyed by goats' milk, continued to drink the milk at frequent intervals. He died rather suddenly early in January, 1906, from pneumonia. His body was treated with embalming fluid before his death was ascertained at the laboratory, and his blood was therefore never tested for the agglutination reaction with *Micrococcus melitensis.* He had complained of liver trouble to the captain of the *Joshua Nicholson*, and was never perfectly well after his return to America. On one occasion several weeks before his death he remarked that his ailment might be Malta fever and suggested that we examine his blood, but unfortunately this was never accomplished. It is possible that he may have been infected with a mild or ambulatory form of the disease either while on the island or during the return journey.

The second person, an elderly lady at the Athenia quarantine station, was in poor health at the time the goats arrived. She was given the milk from the goats for nourishment, and as it agreed with her

she used it daily for some time. She was taken with fever and painful swellings of the joints in October and passed through a typical attack of Malta fever diagnosed by the symptomatology and from the fact that her blood gave a positive agglutination reaction with *Micrococcus melitensis*. The history of this case is absolutely negative as to contact infection, or any other exposure except the infected milk.

The three goatherds remained healthy, but it is probable they all had previous attacks of the disease. The blood of the chief goatherd reacted to the agglutination test upon his return to Malta. The other two were not tested.

THE CAUSATIVE AGENT OF MALTA FEVER.

Micrococcus melitensis, the causal factor of Malta fever, is an aerobic, round or slightly oval micro-organism about 0.4 micron in diameter which usually occurs singly or in pairs, but when cultivated in bouillon appears in short chains. In hanging-drop preparations it shows an active Brownian movement, although according to Gordon this is a true motility due to flagella, which he claims to have stained successfully. The organism is stained by the usual basic aniline dyes, but does not take Gram's stain. Its growth is extremely slow even in the incubator, and it requires a faintly acid medium. In gelatin it grows feebly and without liquefaction. On agar minute transparent or pearly white colonies appear after three or four days, and two days subsequently the growths become amber-colored; later they become more opaque, of a buff color, with granular margins. In bouillon it gives rise to diffuse cloudiness, with a subsequent formation of white flocculent sediment without the formation of a pellicle. In litmus milk the medium is not coagulated, and in ten days to two weeks the milk becomes distinctly alkaline. Indol is not produced. It is pathogenic to monkeys by subcutaneous injection, but, according to Durham, rabbits and guinea pigs are only susceptible to an intracerebral inoculation.

MALTA FEVER IN MAN ON THE ISLAND OF MALTA.

On the Island of Malta there has been endemic for an indefinite period a febrile disease of the inhabitants termed "Malta fever," and also known as "Rock," "Mediterranean," or "undulant fever." It is a specific infectious disease caused by the *Micrococcus melitensis* discovered by Bruce in 1887, and is characterized by an irregular fever of an undulating type, with frequent remissions and relapses, constipation, excessive perspiration, and joint pains, rheumatic in character. It runs a protracted but indefinite course of from three months to a year, with a low rate of mortality of about 2 to 3 per cent.

This disease, which simulates typhoid fever very closely, was so exceedingly prevalent among the British soldiers and sailors stationed on the island that in 1904 a commission was appointed by the English Government, under the supervision of an advisory committee of the British Royal Society, to investigate the possible sources of infection and advise methods for its control.[a] The commission began its work June 13, 1904, and has since investigated the disease in all of its phases in a most exhaustive manner. The work extended over the following three years, and as early as 1905 the commission was led to consider that the milk from Maltese goats was an important, if not the main, factor in the dissemination of Malta fever among human beings. The subsequent experiments showed that a large proportion, reaching upward of 50 per cent, of the 20,000 goats on the island were affected with the disease.

The British Royal Society, hearing of the intended importation of a herd of these goats into the United States, notified the Secretary of Agriculture of its findings in a letter received September 16, 1905, at which time the goats were on the way from Antwerp. The value of this advance information and its importance to our citizens may be appreciated when it is understood that Malta fever is not known to occur in this country except through importation. The Pathological Division of the Bureau of Animal Industry was thereupon directed to take immediate steps to ascertain if any of the goats upon arrival at the Athenia quarantine station were infected with the *Micrococcus melitensis*. Certain facts in the history of the voyage which came to our attention about this time, however, suggested even before any investigations were carried out that some of the imported goats were infected with Malta-fever virus.

INFECTION BY MEANS OF GOATS' MILK.

Zammit[b] noted early in 1905 that the Maltese goats were to some extent affected by Malta fever after they had been fed on living cultures of the *Micrococcus melitensis*. This observation was later confirmed by the finding that the goats were not only able to be artificially infected but that about 50 per cent of them acquired the disease naturally, and that the organisms were eliminated in their milk and urine. It was then decided to investigate the milk of such infected though apparently healthy goats, with the result that in Malta 10 per cent of the goats were found to be eliminating the specific coccus in the milk, and this milk when fed to monkeys even for a day was able to produce typical attacks of Malta fever

[a] A full report of the investigations and experiments of this commission has been published in seven parts. London, England.

[b] Report of the Commission on Mediterranean Fever, part 3, 1905, p. 2.

which ran a course parallel to that of the disease in man. The only logical conclusion which could be formulated from this work was that the Maltese goats were carriers of the virus of Malta fever and one of the principal means of transmitting the disease to human beings through the ingestion of their milk.

All the available evidence points to contaminated food as the vehicle by which these goats become infected with the virus of Malta fever. It has been definitely established that monkeys and goats may be infected in this manner. Furthermore, it has been shown that the urine of infected goats and of ambulatory cases in man at times contains the *Micrococcus melitensis*, so that goats feeding on material that has come in contact with such urine (which is not at all infrequent by the usual method of handling these animals) are readily infected. Thus the frequency and method of infection in goats are quite readily explained.

Other proofs of the transmission of Malta fever to man through the milk of infected goats, in addition to the confirmatory evidence furnished in this article, is forthcoming from a number of experiences which have been noted since regulations were enforced looking to the elimination of goats' milk as a source of infection. Thus the disease is said to have practically disappeared from Gibraltar following the removal of the infected goats; the affection does not occur among the convicts of the civil prison at Malta who are not allowed milk, but Malta fever is nevertheless present in the district where the prison is located; all fresh milk now being supplied to the soldiers at Malta is pasteurized, with the result that Malta fever among them has been reduced 90 per cent, while the disease has not abated among the civil population which continues to use infected milk.

EXPERIMENTS WITH MALTESE GOATS' BLOOD.

The method employed at the commencement of this work in studying the agglutination property of Maltese goats' blood on the *Micrococcus melitensis* was the macroscopic sedimentation test, but this was found to be so unsatisfactory that after a few trials the microscopic agglutination test was substituted and used throughout the remainder of the tests.

Two different strains of *Micrococcus melitensis* were employed in this investigation, one procured from the United States Public Health and Marine-Hospital Service and the other from the laboratory of the United States Army Medical Museum. In the early tests the dilutions used by the Mediterranean-Fever Commission in its routine work—which were as low as 1–10 and 1–20—were employed, with the result that a very high percentage of the animals tested reacted. This result led to the conclusion that the dilution may not have been sufficiently great, and we proceeded to try the same dilu-

tions with the blood of an American goat known to be free from infection with *Micrococcus melitensis* as a check on the agglutination work.

EFFECT OF NORMAL AMERICAN GOATS' BLOOD ON MICROCOCCUS MELITENSIS.

A specimen of blood was obtained under sterile conditions from American goat No. 15, kept at the Bureau of Animal Industry Experiment Station at Bethesda, Md. To 15, 20, and 25 c. c., respectively, of sterile physiological salt solution 1 c. c. of this serum was added, making dilutions of 1–15, 1–20, and 1–25. One platinum loopful of each of these dilutions was then added separately to one loopful of a bouillon culture of *Micrococcus melitensis* 48 hours old and thoroughly mixed on cover glasses. From these the three hanging-drop preparations were made, thus making the final dilutions 1–30, 1–40, and 1–50, respectively. They were watched carefully for signs of agglutination. A control consisting of a hanging drop of the bouillon culture without any added serum was placed under a 4 mm. lens.

At the beginning of the experiment the organisms in all four preparations were free and scattered homogeneously in the fluid throughout the microscopic field.

In the 1–30 dilution agglutination was well marked in 1 hour, and in 2 hours it was perfect, with large clumps and no free organisms.

In the 1–40 dilution agglutination was slight after 1 hour, and in 2 hours small clumps were numerous, with some free organisms.

In the 1–50 dilution after 1 hour no agglutination was present, and in 2½ hours a few very minute clumps could be seen, although the great majority of the organisms were free. In 3½ hours the clumps were more numerous, but even this late it would never be mistaken for a reaction.

The control remained perfectly homogeneous for 3½ hours, when it was discarded.

The above test showed that even normal goats' serum agglutinated *Micrococcus melitensis* to a certain extent. Therefore in examining the Maltese goats' blood, dilutions at least as great as 1–50 were considered essential. It also seemed important to place a time limit on the reaction. From other preliminary trial tests it was decided to use a dilution of 1–70 with a time limit of 1½ hours and only consider animals to be infected when they would react under these conditions.

FEEDING EXPERIMENTS WITH NORMAL AMERICAN GOAT.

An experiment was undertaken to ascertain if it were possible to infect a normal American goat by means of the ingestion of *Micrococcus melitensis* in its food.

On October 14, 1905, American goat No. 4, whose blood had been tested and found not to react with dilutions as low as 1–40, was fed

at the Bureau Experiment Station with the contents of an agar plate containing numerous colonies of *Micrococcus melitensis*, together with one bouillon culture of this organism. Six days later three more bouillon cultures were fed, and on October 22 the final feeding of three additional cultures was made. Twenty-four days after the first feeding a small quantity of the blood was taken from the jugular vein and tested with *Micrococcus melitensis* agglutination. The first dilution tested was 1–60, and a well-marked clumping was produced. Dilutions 1–100, 1–150, 1–200, 1–300, 1–400, 1–500, 1–600, and 1–700 were then tried. Up to the high dilution of 1–400 this goat's blood, which had not reacted before the feeding with a dilution of 1–40, now gave a well-marked reaction. In all of the three higher dilutions clumping occurred, but these cases could only be classed as imperfect reactions, since the clumps were small, and many free organisms were present.

The result of this experiment, together with the similar findings of the Mediterranean-Fever Commission, left no doubt as to the danger of infection of goats from ingestion of *Micrococcus melitensis.*

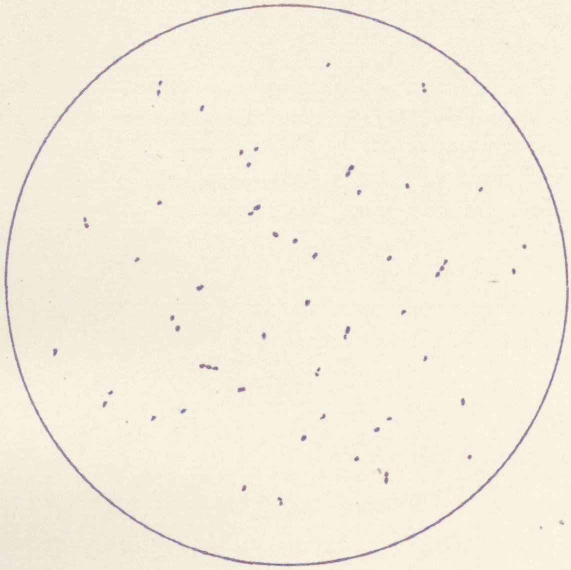
AGGLUTINATION EXPERIMENTS.

AGGLUTININS IN SERUM OF RABBIT INOCULATED WITH MICROCOCCUS MELITENSIS.

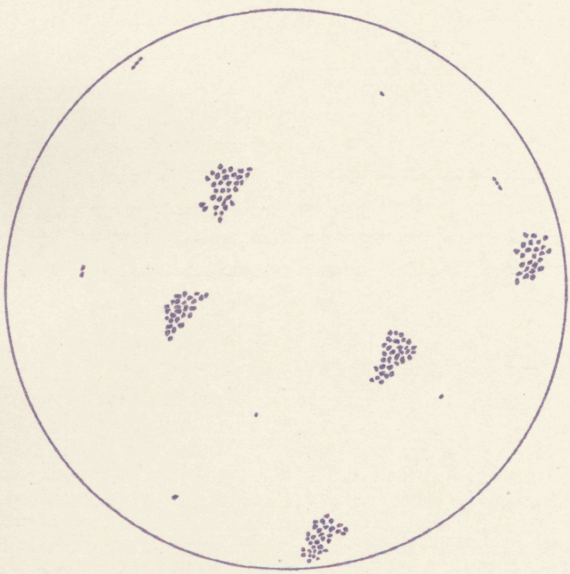
In order to have a constant supply of serum at hand for experimental purposes and for testing any suspected culture of *Micrococcus melitensis*, rabbit No. 1657 was inoculated intravenously in October, 1905, with 0.2 c. c. of a bouillon culture of this organism. In ten days its serum was tested and found to produce a well-marked agglutination of *Micrococcus melitensis* organisms in dilutions as high as 1–100. The rabbit, however, remained healthy and was finally chloroformed over fourteen months later. Culture media were inoculated with the blood and spleen at that time, but they remained sterile and were discarded after seventeen days' incubation.

EXAMINATION OF BLOOD OF GOATS AT ATHENIA QUARANTINE STATION.

With the knowledge acquired from the previously described check experiments, further examinations were made of the blood of the Maltese goats, using the higher dilution and time limit already specified. Specimens of blood were drawn with aseptic precautions by tapping the jugular vein with a small trocar and canula and were then placed in sterile glass vials. The following morning the clear serum had separated in all the containers, and it was then tested for its agglutination properties. These examinations were made of all the adult animals at regular intervals of two weeks, those reacting being placed in hospital quarters removed from the nonreacting animals.



1.—Micrococci from bouillon culture 24 hours old. × 1,000.



2.—Agglutination of micrococci with blood serum from Maltese goat. × 1,000.

MICROCOCCUS MELITENSIS, THE CAUSATIVE AGENT OF MALTA FEVER.

The terms "good," "imperfect," and "no reaction" were used to designate the results of the test. A good reaction was considered to be one in which inside of the time limit of one and one-half hours the serum at a dilution of 1–70 produced a clumping of the bacteria in large clumps with no free organisms remaining in the field. Imperfect reaction was applied to those in which at the end of one and one-half hours small clumps were present but, in addition, some free organisms remained. No reaction was one in which the micrococci remained homogeneous in the hanging drop with no evidence of clumping.

It is probable that all of the imperfect reactors either were or had been infected with *Micrococcus melitensis*, as, upon making repeated examinations at varying intervals of time with blood from the same goat, it was occasionally found that a good reaction would be obtained while at other times it would be imperfect, and vice versa. By the above method of classification the 44 goats remaining at Athenia were examined up to December 22, 1905, with the result that 11 gave a good reaction, 9 an imperfect reaction, and 24 no reaction. The other 16 goats of the shipment not included in this number (5 having died on the ocean voyage to this country) will be referred to below.

EXAMINATION OF GOATS AT COLLEGE PARK.

Early in November, 1905, the herd of goats at Athenia was divided, 16 of the nonreacting animals being shipped from Athenia to the Maryland Agricultural Experiment Station at College Park and kept there under quarantine. Samples of blood were drawn from these 16 animals at different times under the same conditions as have already been described, with the result that by December 2, 1905, 6 gave a good reaction, 5 an imperfect reaction, and 5 failed to react.

These 6 good reactors at College Park were then destroyed and the remaining 10 animals again tested two weeks later for the blood reaction. At this test goat No. 88, which on the previous examination gave an imperfect reaction, now gave a good reaction, and Nos. 81 and 91, which before gave no reaction, now gave an imperfect reaction. The results consequently were: Good reaction, 1; imperfect reaction, 6; no reaction, 3.

The infection therefore seemed to be spreading despite the fact that isolation and disinfection were practiced, and only 3 instead of 5 could be positively pronounced free from the organisms of Malta fever. This was not surprising, as the cold weather lowered the vitality of the animals, and they had previously been constantly subjected to infection from the ingestion of forage soiled by the urine of the reacting goats. These College Park animals were subsequently moved to the Bureau Experiment Station at Bethesda, Md.

EXAMINATION OF MILK OF REACTING GOATS.

From the fact that such a large proportion of reactions resulted from the agglutination tests, it was at once decided to endeavor to isolate the specific organism from the milk of these goats and thus demonstrate more forcibly the danger of their spreading Malta fever in the United States.

On December 11, 1905, milk was obtained in sterile wide-mouthed glass bottles from goats Nos. 19, 40, 54, 58, 65, 82, 84, and 85, all of which had given either a good or an imperfect agglutination reaction. The samples of milk were brought to the laboratory and plated at once in the ordinary manner of isolating organisms from mixed cultures, three plates being used for each specimen of milk. After four days' incubation many suspicious colonies were found on the plates from goats 19 and 40. Cultures were made from these colonies and the organisms put through the ordinary determinative tests for classifying bacteria. In both cases the organisms were found to be decolorized by Gram's stain and grew on gelatin without liquefaction and in litmus milk without altering the medium. The final proof that they were the *Micrococcus melitensis* was secured when on testing them with specific serum from an infected animal they were agglutinated in large clumps. The plates made from the other animals were negative for *Micrococcus melitensis*.

This experiment proved beyond doubt that at least 2 of the 8 goats examined were excreting *Micrococcus melitensis* in large numbers in their milk, which was perfectly normal to all appearances and chemical analysis. Subsequent examinations of other reacting goats revealed the presence of this micrococcus in the milk of 2 additional animals, making a total of 4 goats that were eliminating the *Micrococcus melitensis* in their milk.

EXAMINATION OF URINE OF REACTING GOATS.

From a number of the reacting and imperfectly reacting Maltese goats, urine was collected in as aseptic a condition as possible in the following manner: After washing off the external genitalia with a 5 per cent carbolic-acid solution, a sterile catheter was passed along the floor of the vagina to the urethra and into the bladder. The urine was collected in sterile glass bottles and taken to the laboratory and plated at once in the same manner as had been done with the milk. Of the 11 specimens examined, *Micrococcus melitensis* was recovered from 1—goat No. 40—which animal was also known to be excreting the organisms very plentifully in its milk.

The fact that only one of the animals examined showed the presence of the organism in its urine is not surprising when we consider the result of similar examinations by the Mediterranean-Fever Com-

mission. After a very great number of bacteriological examinations of goat urine the commission concluded that the excretion of the organisms in the urine was a late phenomenon and that in many infected goats they would only be present in the urine in gushes for short intervals and then disappear. Frequent urine examinations therefore would probably have revealed this excretion infectious in a greater proportion of cases.

The time required for making the milk and urine examinations, however, was very great, and as we had now proved that both were infectious, this work was abandoned, and in the later experiments all animals were considered dangereous from a public-health standpoint which upon examination of their blood showed specific agglutinins for *Micrococcus melitensis.*

PATHOLOGICAL ANATOMY OF LESIONS IN GOATS.

While the post-mortem lesions in man are indicative of a general septicemic infection, with the causative micrococcus frequently demonstrable not only in the peripheral blood, but also in the internal viscera, such as the spleen and heart, nevertheless the animals examined in this investigation failed to show any evidence of septicemia in the majority of cases. In fact, the micrococcus was found in the blood of some goats when the spleen and other tissues were apparently normal macroscopically. In several cases, however, the spleen was enlarged, the liver engorged, the kidneys inflamed, and the lymph glands, especially the mesenterics and inguinals, edematous and swollen. In three reacting goats the lungs were found to be congested along the borders, and occasionally pneumonic consolidation was present. On the other hand, the infection of man has been shown to be extensive with the *Micrococcus melitensis* present in the previously mentioned tissues as well as in the pericardial fluid, kidneys, liver, gall bladder, pancreas, and thyroid, salivary, and suprarenal glands.

CONDITION OF HEALTH OF THE INFECTED ANIMALS.

It would appear from our investigation that the organism of Malta fever lives a more or less passive existence in the body of the goat, exercising its pathogenic effect when it gains entrance to the human body. The symptoms in those goats whose blood gave a positive reaction were not apparent except in a few cases, and even in these instances it is possible that the symptoms of anorexia, diarrhea, weakness, etc., were the result of one of the several intercurrent diseases with which a number of the goats became affected.

As an illustration of the condition of the reacting animals, attention is called to goat No. 40, which, although excreting the organisms abundantly in both its milk and urine, was the finest looking goat

in the herd. But it was noticed at College Park, where very careful observations and records of the animals were made, that the reactors did not readily conceive; four of them had come in œstrum three times, although they were served each time, one billy having been shipped to the park. On the other hand, the nonreactors conceived with but one service. During the investigations many of the goats became ill with pneumonia, pleurisy, enteritis, metritis, rheumatism, etc., and developed various symptoms which should be attributed to these different diseases rather than to the Malta-fever virus.

METHOD OF TREATING THE GOATS AT THE EXPERIMENT STATION.

It had now become definitely established that some of the goats were excreting *Micrococcus melitensis* in their milk and urine, and that a large percentage were undoubtedly infected with this organism, as shown by the specific agglutination reaction of the blood. These facts were further strengthened at this time by the development of a typical case of Malta fever in the woman at the quarantine station, who had used the milk in considerable quantity.

About this time the agricultural experiment stations in Connecticut and Maryland had made preparations to carry on experiments with the animals, and the Bureau was very anxious to save a portion of the herd if it could be demonstrated beyond all doubt that they were free from the infection of Malta fever. It was therefore decided that all the animals giving a good reaction at Athenia be destroyed and the remainder sent to the Bureau Experiment Station at Bethesda, Md., at which point they could be kept in quarantine and at the same time be much more convenient to the laboratory for future work. Early in January, 1906, this plan was carried out.

The winter climate at Athenia was very different from the semitropical Mediterranean, and 9 of the original herd had died, mainly from pneumonia and muco-enteritis. All the remaining reactors were then destroyed and the remainder of the herd was sent to the Bureau Experiment Station.

As Malta fever in man is not a highly virulent disease, the mortality being about 2 or 3 per cent, it is consequently fair to presume that as the disease is less virulent in goats these animals would probably be more amenable to treatment than the human. Therefore, after their arrival at Bethesda, the adult goats were placed on a mixture of 20 grains of potassium iodid and 15 grains of salol per head in their feed twice daily for one month. Quinin was then substituted for the potassium iodid and the treatment continued one month longer. By this system of treatment it was hoped that any latent virus of the disease which might be present in the tissues of the animals would be overcome and destroyed.

SERUM REACTION OF GOATS AFTER TREATMENT WITH DRUGS.

On March 29, 1906, blood was drawn from 12 of the goats at the station which had been under the medicinal treatment for two months. Of this number 7 gave a good, 3 an imperfect, and 2 no reaction, thus showing little hope of eradicating the infection by internal drug administration. While the serum might probably have reacted as a result of the presence of agglutinins formed before the treatment became effective, even though no living *Micrococcus melitensis* existed in the blood or tissues, it was not thought advisable to assume any risk with a disease of this character, and therefore no further lines of treatment were attempted.

It should be stated in connection with the medicinal treatment of these goats that at all times attempts were made to segregate the infected and suspicious from the noninfected animals. The continued spread of the disease at Athenia is apparently explained by the fact that the blood of the goatherd, a native of Malta and apparently in robust health, was subsequently found to react to the agglutination test, and it is not at all unlikely that he was either an ambulatory case or a "bacillus carrier," and that he was the cause of the infection in at least some of the reacting goats, inasmuch as his quarters were in the one-story building with them. After the animals arrived at Bethesda a large number of isolated pens, separated by at least 25 feet of ground, were used for stabling them, and not more than two goats were placed in each pen. If one of the two reacted or gave a suspicious reaction, the nonreacting animal was immediately removed to another previously unoccupied pen, and the original pen and feeding troughs were then thoroughly disinfected and the bedding, litter, etc., burned.

HEALTH OF GOATS AT BUREAU EXPERIMENT STATION.

The general condition of the goats after their arrival at the Bureau Experiment Station grew from bad to worse. They were multiplying rapidly, however, some of the nannies having twins and several having triplets. It seemed that they were unable to stand the climatic conditions, and adults and kids died in considerable numbers.

The adults on post-mortem showed the cause of death to be due to various conditions, by far the most prevalent being pneumonia and pleurisy. Septic metritis following difficult parturition caused some deaths, gastro-enteritis was responsible for other fatalities, and in one case acute pancreatitis with fat necrosis was the cause.

The kids were practically all affected with articular rheumatism and their joints became swollen and in many cases permanent deformities resulted. All the kids which came to post-mortem from

Bethesda showed severe infestation with intestinal coccidiosis. Pneumonia, goiter, and enteritis also caused fatalities.

Cultures were made from the viscera of many of the dead animals. In three adult cases the *Micrococcus melitensis* was recovered, cultures being obtained from the spleens of these animals in each instance.

Although the lymphatic glands, especially the mesenterics, were markedly enlarged and edematous in a number of the kids, which is one of the main anatomical points of evidence of infection in goats, the *Micrococcus melitensis* was recovered from only one of these animals.

FINAL AGGLUTINATION TESTS.

On June 1, 1906, the blood of each of the remaining adults, 25 in number, was again tested, and 8 good, 8 imperfect, and 9 negative reactions were obtained.

From July 2 to July 18, 1906, all the remaining kids, totaling 57, were tested, the results showing 21 reactions and 36 which did not respond. As it was the intention to kill off all the kids whose blood showed any evidence of agglutination, imperfect reactions were all classed as reactions. The 21 reacting kids, together with the 8 adults which gave a good reaction, were killed after this test.

On October 17, 1906, the 17 remaining adults were again tested, and 2 of the 8 which on June 1 had given an imperfect reaction now gave a good reaction.

By this time it had become thoroughly recognized by all parties concerned that the use of the goats for the purposes for which they had been imported would be accompanied with considerable danger of serious results. It was therefore decided to dispose of the herd, and in November, over a year after their arrival, all the remaining goats, including the kids, were destroyed.

CONCLUSIONS.

1. It has been definitely demonstrated that the *Micrococcus melitensis*, the organism of Malta fever, has a more or less passive existence in the body of Maltese goats, exercising its pathogenic effect when it gains entrance to the human body.

2. These goats, when carriers of the virus of Malta fever, are one of the important factors, if not the principal factor, in the dissemination of this disease, through the ingestion of their milk by human beings.

3. Goats infected with Malta fever eliminate the causative agent of the disease in both the milk and the urine.

4. All the available evidence points to contaminated food as the vehicle by which the goats become infected with the organism of Malta fever. The urine of infected goats and of ambulatory cases

in man at times contains the *Micrococcus melitensis*, so that normal goats feeding on material which had come in contact with such urine are readily infected. Thus the frequency and the method of infection in goats are quite easily explained.

5. An elderly woman who had consumed a considerable quantity of the Maltese goats' milk at the Athenia quarantine station had a typical attack of Malta fever, diagnosed by the symptoms and the reaction of her blood serum to the agglutination test. This case is the first one recorded in which infection by goats' milk is directly demonstrated when contact infection and other modes of exposure were entirely eliminated.

6. So long as Malta fever remains so prevalent in the Island of Malta, and such a large percentage of the native goats are passive carriers of the *Micrococcus melitensis*, it will be impracticable to attempt to introduce these animals into the United States. Even if they were assuredly free from *Micrococcus melitensis*, it is doubtful, on account of climatic conditions, whether they could be profitably bred in this country, except in the extreme Southern States.

THE VITALITY OF TYPHOID BACILLI IN MILK AND BUTTER.

By Henry J. Washburn,
Senior Pathologist, Pathological Division.

TYPHOID CASES TRACEABLE TO MILK.

The investigation of the cases of typhoid fever which have occurred in the District of Columbia during the past three years shows that one of the important factors in the spread of this disease is to be found in the market milk which is supplied to District inhabitants. The Hygienic Laboratory of the United States Public Health and Marine-Hospital Service found that 11 per cent of the cases in the year 1906 owed their origin to infected milk, in 1907 about 9 per cent of the cases were similarly caused, and in 1908 the percentage reached about 10 per cent, which is the average percentage shown by their records for the three years above mentioned. These percentages were based upon the number of cases actually traced to infected milk.[a] Other investigators have claimed that dairy products were the conveyers of this disease in as high as 15 per cent of cases, which only tends to emphasize the difficulties that investigators always encounter when they attempt to trace the cases of typhoid fever in any outbreak to an incontestable origin.

Taking into consideration the fact that typhoid fever is a disease that is present in all countries, at all seasons of the year, and among all classes and conditions of people, it at once becomes evident that 10 per cent of the annual aggregate number of attacks represents a large amount of preventable sickness and suffering.

SOURCES OF TYPHOID CONTAMINATION IN MILK AND ITS PRODUCTS.

The typhoid-fever organism thrives admirably in milk at suitable temperatures and reproduces with great rapidity when in this medium under favorable conditions. Milk as it is drawn from the cow does not contain typhoid bacilli, but it may quickly become contaminated from extraneous sources and is then ready to convey the infection to the person using it, either as a beverage or in the form of butter or cheese manufactured from it. Numerous tests have shown that even though typhoid bacilli are administered to a dairy cow in great numbers by drenching they will be so disposed of during the

[a] Hygienic Laboratory Bulletin 35.

act of food assimilation that they will not be excreted through the mammary organs. We may therefore safely assume that all milk as produced by the dairy cow is free from contamination with typhoid bacilli; nevertheless, some of these organisms may gain entrance to it before it leaves the farm, while in transit to the market, at the distributing point, while being delivered at the homes of the consumers, or within these homes while being kept until needed for any of its usual varied domestic uses. Contamination may occur at any of these places through pouring the milk into vessels that have been soiled with typhoid infection, either directly with discharges from a typhoid-fever patient, or indirectly through infected wash water; by the entrance of germ-bearing flies to the can or bottle in which it is being stored; or by being handled by people who are themselves suffering from the disease in a mild form or who are caring for typhoid-fever patients. When we consider the small number of bacilli required to furnish the nucleus for a thrifty colony in a can of milk, and the great rapidity with which they multiply and pass through the fluid from one part of the can to another, we can only wonder that the infection of milk occurs as infrequently as it does.

The house fly is recognized as a dangerous conveyer of infectious material, and if permitted to do so, there is no place to which he more readily carries typhoid infection, should he become smeared with it, than into a milk pan or a cream vat. It is not an uncommon occurrence at certain seasons of the year for flies to fall into the family milk supply, or into the cans or vats at the creamery. Such accidents are most frequent at a time of year in which typhoid fever is usually quite frequent—that is, in the late summer and fall. Ordinarily these struggling flies are harmless to the consumer of the milk in which they fall, whether they crawl out or drown. It is only in the exceptional cases of their contamination with some infectious disease that serious results may follow.

Since the typhoid organism thrives so well in milk, the question very naturally arises, What dangers are presented to humanity by the various dairy products through the possibility of their harboring typhoid bacilli, possibly for a period of months, and later conveying them to the digestive tracts of the consumers?

EXPERIMENTS TO DETERMINE THE PERSISTENCE OF TYPHOID BACILLI IN MILK AND BUTTER.

Typhoid bacilli in milk or butter will live and retain their active virulent properties for weeks and even months. In order to determine the length of this endurance when the infected dairy products are kept under common market conditions, the Pathological Division of the Bureau of Animal Industry recently prepared some samples of milk and butter purposely infected with typhoid bacilli and kept

them in an ice chest at the laboratory, where they were easily available for daily examination.

PERSISTENCE IN BUTTER.

The butter was prepared by adding a quantity of typhoid culture, scraped from a thrifty growth upon glycerin agar, to the cream from which the butter was to be made just before it was placed in the churn for churning. After the churning the buttermilk was worked out, salt in the usual proportions was added, and the finished product was then packed securely in small glass jars which were kept in cold storage until the completion of the investigation.

Tests of this butter were made by plating every two or three days following its manufacture, as by this process the presence of living typhoid bacilli could readily be demonstrated. Each day that a test was made a bouillon culture tube and two agar plates were prepared. The preparations made on certain days would occasionally prove sterile. This was probably due to the fact that the needle with which the sample was removed from the bulk of butter in the jar passed into a portion of the mass in which no typhoid bacilli happened to be left at the final working and packing. This supposition seemed warranted by the fact that plates made from other portions of the same jar on the following day frequently developed good colonies of typhoid bacilli. The tests were continued until negative results had been obtained with eight consecutive platings, extending over a period of fifteen days.

Living colonies of typhoid bacilli developed in plates that were made from butter made and stored as described above on the one hundred and fifty-first day after its manufacture. This proves that typhoid bacilli will retain their vitality under these conditions for one hundred and fifty-one days, and that during this period these microorganisms are ready to multiply whenever they are placed in suitable environment. Suitable conditions may be furnished by the system of some person who during this time unknowingly eats infected butter supposing it to be wholesome.

PERSISTENCE IN MILK.

The length of time that typhoid bacilli will remain active under common market conditions in milk far exceeds the period during which it is ordinarily kept before being put to some sort of domestic use. We have taken tubes of culture milk, inoculated them with typhoid bacilli, incubated them at body temperature over night, and then found on examination under the microscope that the fluid was fairly swarming with actively moving bacilli. These samples of infected milk were then placed in the laboratory ice chest for storage.

Examination, repeated at intervals of three or four days, showed that the organisms retained active motility for some twenty days, and the number of organisms present in each drop at the time of its examination had apparently suffered no diminution up to this point. Later than this there was a gradual lessening in the number present and their motions were less active until, on the forty-third day, they had practically disappeared. Sterilization of the cream previous to its being churned is therefore indicated in all cases in which there is any possibility of typhoid infection.

ADVANTAGES OF PASTEURIZING MILK AND CREAM.

It has been found by means of numerous experiments that milk may be subjected to heat in such a manner and for such a length of time that all of the pathogenic bacteria which it may contain will be rendered harmless, and yet no alteration of the character or digestibility of the milk will result. The application of a temperature of 60° C. (or 140° F.) for twenty minutes will deprive typhoid bacilli and also the specific organisms of diphtheria, dysentery, cholera, and tuberculosis of all their harmful powers, and the pasteurization of milk or cream under these requirements will result in food products that are perfectly safe and that retain at the same time all of their original nutrient properties.

Whenever untraceable outbreaks of typhoid fever occur it might be well, while searching for a possible source, to bear in mind the fact that dairy products offer satisfactory shelter and nutriment to typhoid bacilli whenever they come in contact with them, and an investigation of the milk and butter supplies of the several affected families should therefore be made.

THE ACTION OF SALTPETER UPON THE COLOR OF MEAT.

By Ralph Hoagland,
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INTRODUCTION.

The importance of the meat-curing industry of the United States is apparent to anyone who considers that by far the larger portion of the hogs butchered is sold, not as fresh pork, but as cured or salt meat in the form of hams, bacon, mess pork, dry-salt meat, etc. There is also a large amount of pork cured by farmers for home consumption which is not generally considered in an estimate of our meat production. A considerable amount of beef is also pickled to be sold as corned beef, either canned or in bulk, or it is smoked and sold as dried beef.

The process of curing meat in practice at the large meat-packing establishments is, in general, the same in each one. The substances allowed by the regulations of the Secretary of Agriculture to be used in the curing of meat which is to enter interstate commerce are salt, sugar, saltpeter, spices, vinegar, and wood smoke. Pork is cured either by the dry process, in which a mixture of salt, saltpeter, and sugar is rubbed into the meat, or by pickling the meat in a brine containing these ingredients. By far the larger amount of pork is cured in pickle. A similar pickle is commonly used in curing beef.

Practically all farmers who cure their own pork add a little saltpeter to the brine, and there is probably not a packing house in this country which does not use saltpeter in the curing of meats as well as in the manufacture of many brands of sausage.

Saltpeter is used in the curing of meats for two reasons: (1) It has a very decided preservative action when properly used—preventing the souring of meat; and (2) it acts upon the meat so as to preserve its natural color, or, more properly speaking, it gives to the cured meat an attractive color which is in some cases brighter than the natural color. Since borax and boric acid are not permitted in the curing of meats for interstate commerce, saltpeter is very highly prized by the packers on account of its preservative action. The question of whether or not saltpeter is harmful to health is not dealt

with in this paper, the purpose being to treat only of its action upon the coloring matter of meat.

The action of saltpeter upon the color of meat is very apparent to anyone who has observed the bright-red color of corned beef which has been cured in pickle containing saltpeter. The same bright color may be noticed in a slice of smoked ham, in the lean meat of bacon, and especially in the case of summer sausage, in which saltpeter plays a very important part in the production of color.

REVIEW OF SOME PREVIOUS PUBLICATIONS.

In view of the importance of our meat-curing industry, it is surprising that in this country practically no attention from a scientific standpoint has been given to the changes which take place in meats during the process of curing. The action of saltpeter upon the coloring matter of meat has been given considerable attention by European investigators, but the results obtained have not been entirely in accord.

Mitchell [1] [a] in his handbook on flesh foods discusses the action of saltpeter upon the coloring matter of flesh, and quotes experiments by Weller and Riegel. These investigators obtained a bright-red ether extract from sausage prepared with saltpeter, and concluded that the color was due to the action of the saltpeter upon the coloring matter of the meat. The hemoglobin was found to have undergone alteration and to give a spectrum resembling methemoglobin. On treating hog's flesh containing blood with saltpeter they were able to obtain a colored extract with ether, but, on the other hand, were unable to obtain the color from flesh not containing blood.

E. Spaeth, also quoted by Mitchell, was unable to confirm the results obtained by Weller and Riegel relative to the action of saltpeter upon hog's blood.

Ostertag [2] notes Weller and Riegel's experiments and also quotes Glage to the effect that the persistence of the red color of salt meat is not due to the saltpeter, but to nitrites, and perhaps nitric oxid, which are formed from the saltpeter in the brine.

Haldane [3] in an article entitled "The red color of salted meat" treats quite fully of the action of saltpeter as a flesh-color preservative. As the result of his investigations he reaches the following conclusions:

1. The red color of cooked salt meat is due to the presence of NO hemochromogen.

2. The NO hemochromogen is produced by the decomposition by heat of NO hemoglobin, to which the red color of unsalted (?) [b] meat is due.

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[a] Figures refer to bibliography at end of article.

[b] The term "unsalted" as it appears here is evidently a misprint, as the body of the paper clearly shows that *uncooked salted* meat is referred to.

3. The NO hemoglobin is formed by the action of nitrite on hemoglobin, in the absence of oxygen and in presence of reducing agents.
4. The nitrite is formed by reduction within the raw meat of the niter used in salting.
5. The nitrite is destroyed by prolonged cooking.

These conclusions are given in full because they represent probably the most comprehensive statement yet published of the action of saltpeter as a flesh-color preservative.

EXPERIMENTAL WORK.

The results of numerous experiments conducted in this laboratory agree in general with the conclusions given by Haldane, the object of these experiments being to verify the work of Haldane, and to investigate further the action of saltpeter upon the color of meats in the process of curing.

The natural color of meat is due to the presence of hemoglobin, a part of which is found in the blood remaining in the flesh, due to incomplete bleeding of the animal, while the remainder is found in the muscles themselves. Any action, then, that saltpeter has as a means of influencing the natural color of the meat is an action between the saltpeter, or its decomposition products, and hemoglobin.

It is a well-known fact that hemoglobin unites readily with various gases. As a carrier of oxygen in the blood it unites in the lungs with oxygen to form oxyhemoglobin, to which the bright-red color of arterial blood is due. It likewise unites readily with carbon monoxid to form CO hemoglobin, with carbon dioxid to form CO_2 hemoglobin, and with nitric oxid to form NO hemoglobin. Of all these compounds NO hemoglobin is the most stable.

In the examination of a large number of samples of sausage for artificial coloring matter it was found that numerous highly colored samples gave on extraction with ether or alcohol a deep cherry-red extract; on extraction with alcohol the color always separated with the fat, from which it could not be separated. This color would not dye wool and responded to none of the tests for vegetable colors. On standing for some time the ether solution of the color turned a dirty brown. A peculiar characteristic of the ether solution of the color was that on treating with strong ammonia the color was all precipitated and formed an intensely red-colored layer at the bottom.

This same color was also obtained on extracting dried or corned beef with ether. It was finally identified as being in some manner a product of the action of saltpeter upon hemoglobin, since invariably all meats giving this color on extraction with ether were found to contain saltpeter.

The color formed by the action of saltpeter or its decomposition products upon hemoglobin was considered by Haldane as being NO

hemoglobin. This compound was discovered by Hermann[4] in 1865, and was made by passing a current of nitric oxid gas into blood in the absence of oxygen. The experiment was repeated in this laboratory by passing nitric oxid gas into steer's blood. The blood was then extracted with ether, and an intensely red-colored extract, which corresponded in all respects to the color obtained from meats in which saltpeter had been used as a preservative agent, was obtained. It may be stated that in no case was this bright-red colored ether extract obtained from meats which did not contain saltpeter or its decomposition products.

ACTION OF SALTPETER ON BLOOD.

In order to determine the action of saltpeter upon the hemoglobin of blood the following experiment was conducted: Samples of fresh steer's blood were treated with various amounts of saltpeter ranging from 0.05 to 0.5 per cent. The samples, including a blank to which no saltpeter had been added, were placed in a refrigerator at a temperature of 13° C. and were examined at intervals up to two weeks, but in no case did any of these samples give a colored extract with ether. At the end of a week portions of the samples were acidified with acetic acid, and all except the blank gave a bright-red colored ether extract. Nitrites were found in all samples giving the colored extract with ether. It was also found that all samples of blood remained alkaline throughout the experiment.

This experiment shows very clearly the manner in which saltpeter acts upon hemoglobin. Saltpeter as such has no action upon the hemoglobin of blood. When added to blood, saltpeter undergoes reduction to potassium nitrite, but the nitrite is not reduced to nitric oxid owing to the alkaline reaction of the blood, and hence no nitric oxid hemoglobin is formed. When a sample of blood containing potassium nitrite is acidified the nitrite is reduced to nitric oxid, which acts upon the hemoglobin to form NO hemoglobin, which may be extracted with ether. As has been shown by the above experiment, nitrites as such have no action upon hemoglobin to form a red coloring matter.

The results of this experiment showing that nitrites as such have no action upon hemoglobin to form NO hemoglobin are in direct contradiction to one of Haldane's experiments, which was as follows:[5] To carry out the experiment fresh blood slightly diluted was introduced into a glass vessel, with stopcocks at both ends, connected with an ordinary filter pump slightly warmed, and all oxygen was boiled out. A saturated solution of sodium nitrite was then drawn in without air. After a short time the spectrum of reduced hemoglobin changed into that of NO hemoglobin accompanied by a weak methemoglobin band in red.

No mention is made as to the reaction of the blood used in this experiment, neither is it stated whether or not an acid was added. The statement in the above experiment that NO hemoglobin was formed naturally implies that the nitrite must have been reduced to nitric oxid. In the description given by Haldane, however, the manner in which the breaking down of the nitrite was brought about is not made clear.

The writer repeated Haldane's experiment in the following manner: About 100 c. c. of fresh defibrinated steer's blood was placed in a glass vessel with stopcocks at each end and connected with a water suction pump. The vessel was slightly warmed under a hot-water tap and the air exhausted as far as possible, the vessel being shaken to aid in the process. The suction was disconnected and a 1 per cent solution of KNO_2 was drawn in without air. The vessel was allowed to stand a short time, and portions of the blood were then removed and extracted with ether, but in no case was a colored extract obtained. Another portion of this blood was acidified with a few drops of acetic acid and shaken with ether, when a bright red extract was obtained. The sample of blood used in this experiment was alkaline in reaction, and no NO hemoglobin was formed after the addition of the nitrite, even with the air exhausted from the blood, until the blood had been acidified, thus causing the nitrite to be broken down into nitric oxid with the consequent formation of NO hemoglobin. It is very easy to see how, when a nitrite is added to slightly acidified blood, a mixture of methemoglobin and NO hemoglobin may be formed, since a part of the nitrite is broken down to nitric oxid forming NO hemoglobin, while a part of the nitrite acts directly on hemoglobin to form methemoglobin.

It is quite generally considered that when nitrites are added to blood methemoglobin and not NO hemoglobin is formed.

In Watts's Dictionary of Chemistry [6] it is stated that methemoglobin may be obtained by adding oxidizing agents to blood or to a solution of hemoglobin or oxyhemoglobin—e. g., potassium permanganate, potassium ferricyanide, nitrites.

Wood,[7] in "Therapeutics: Its Principles and Practice," in writing of nitrite poisoning, says:

> The appearance of the chocolate-brown color of the blood is due to the formation out of the hemoglobin of a new substance which Gamgee believed to be nitrite oxyhemoglobin, but which has been considered by most observers, on account of similarity of spectrum, to be the methemoglobin of Hoppe-Seyler.

The results of the writer's experiments are also in direct opposition to the conclusions of Weller and Riegel, that saltpeter acted upon hog's blood alone to form a red coloring matter.

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ACTION OF SALTPETER ON MEAT.

In order to test the action of saltpeter upon the coloring matter of meats, three samples of finely ground fresh beef were prepared as follows:

Sample No. 1 contained 1 per cent KNO_3 and 2 per cent NaCl.

Sample No. 2 contained 1 per cent KNO_3, 2 per cent NaCl, and 1 per cent $NaHCO_3$.

Sample No. 3 contained 2 per cent NaCl.

The saltpeter was added in solution, while the salt and sodium bicarbonate were added dry.

These samples were tightly packed in glass jars and placed in a refrigerator at a temperature of 13° C. At the end of twenty-four hours the samples were of practically the same appearance, though No. 2 was somewhat brighter in color than the other samples. No nitrites had been formed in any of the samples, and no red-colored extract could be obtained with ether. Portions of the samples were again examined at the end of three days. Sample No. 1 was of normal color, except that the surface had taken on a dirty-brown appearance. Sample No. 2 was bright red in color and the surface was of the same color as the interior, in contrast to the exposed surface of No. 1. Sample No. 3 had changed in color to a dull brown, most noticeable on the exposed surface. Samples Nos. 1 and 2 contained considerable amounts of nitrites, while No. 3 contained none. Sample No. 1 gave on extraction with ether the characteristic red-colored NO hemoglobin. Sample No. 2 gave no red-colored extract, nor did sample No. 3. However, on acidifying sample No. 2 with a few drops of acetic acid a red-colored extract was obtained with ether. A normal meat, even when acidified with acetic acid, does not give a red-colored extract with ether, but sometimes a sort of brownish extract which has none of the characteristics of NO hemoglobin.

The reason for the colored ether extract being obtained from sample No. 2 after acidifying the same is due to the decomposition of the nitrite by acid, liberating nitrogen trioxid, which in the presence of water breaks down into nitric oxid, and this acts upon the hemoglobin to form NO hemoglobin. A similar experiment was made with three samples of pork, with like results except that the production of nitrites and the development of color were slower in the pork than in the beef.

These observations show (1) that saltpeter when added to fresh meat undergoes reduction to potassium nitrite; (2) that saltpeter in itself has no action upon hemoglobin, the coloring matter of meat; (3) that the reduction of saltpeter to nitrite in the meat takes place equally well in either an alkaline or an acid medium; (4) that potas-

sium nitrite as such has no action upon hemoglobin to form a red coloring matter, but in the presence of an acid is reduced to nitric oxid which acts upon hemoglobin to form NO hemoglobin, to which the red color of salted meat is due.

The fact that the saltpeter is reduced to nitrite equally well in either an alkaline or an acid medium, as was shown in the case of samples Nos. 1 and 2, and that the nitrite in the presence of an alkaline medium in sample No. 2 had no action upon the hemoglobin, seems to show that nitrites as such have no action upon hemoglobin to form NO hemoglobin. However, the nitrite in the presence of the natural acid of the meat was reduced to nitric oxid, which acted upon the hemoglobin to form NO hemoglobin, the compound described by Haldane and others, and to which the red color of uncooked salted meat is due.

The action of meat in reducing saltpeter to a nitrite is very marked. When saltpeter is mixed with finely chopped fresh meat the reduction to nitrites often takes place within a few hours. The amount of nitrites produced from a given amount of saltpeter in meat seems to vary directly with the temperature, within moderate limits, at which the sample is kept. Near freezing temperature the reduction is quite slow, while at room temperature it is much more rapid. When meat to which saltpeter has been added begins to undergo decomposition, the production of nitrites is especially rapid.

THE REDUCTION OF SALTPETER TO NITRITES.

There is a difference of opinion among investigators as to the cause of the reduction of saltpeter to nitrites. Abelous and Gérard [8] have shown that the various organs, as well as the striated muscles, possess the property of reducing nitrites in the absence of bacteria.

E. Polenske [9, 10] found that a sterilized solution of saltpeter contained no nitrites, but that in a short time after the addition of a drop of unsterilized pickle the saltpeter began to disappear with the consequent formation of nitrites. He conducted numerous experiments along this line and as a result of this work concluded that saltpeter was destroyed by micro-organisms.

The writer's observations have shown that saltpeter is reduced to a nitrite within a comparatively short time when added to fresh blood or to finely chopped fresh meat. It has also been noticed that when meat containing saltpeter starts to undergo putrefaction, the reduction of saltpeter takes place very rapidly. In the experimental curing of hams in a pickle containing salt, sugar, and saltpeter, conducted by this laboratory, the original fresh pickle contained no nitrites, but after being added to the vat of hams the nitrite content of the pickle increased steadily throughout a curing period of fifty-

five days. Saltpeter is undoubtedly reduced by bacteria, and according to Abelous and Gérard various organs and the striated muscles possess the power of reducing saltpeter in the absence of bacteria. At this time the writer is unable to state which of these factors plays the most important part in the reduction of saltpeter in the curing of meats.

EFFECT OF NITRITES ON HEMOGLOBIN.

In order to test the action of nitrites upon the coloring matter of meats, two samples of fresh beef were prepared as follows:

Sample No. 1 contained 0.01 per cent KNO_2.
Sample No. 2 contained 0.01 per cent KNO_2 and 1 per cent $NaHCO_3$.

The nitrite was added in solution.

The samples were tightly packed in glass jars and placed in a refrigerator at a temperature of 13° C. Sample No. 1 turned brown immediately on adding the nitrite, but after standing for some time recovered its normal color except on the surface, where the brown color persisted. Sample No. 2 turned slightly brown on adding the nitrite, but recovered its normal color after being packed in the glass jar. The exposed surface of this sample also resumed its natural color, in contrast to sample No. 1. On extraction with ether, sample No. 1 gave up a bright-red colored extract of NO hemoglobin, but sample No. 2 gave no red-colored extract whatever. On acidifying sample No. 2 with a few drops of acetic acid the characteristic red-colored extract of NO hemoglobin was obtained.

These results show that nitrites as such have no action upon the coloring matter of meat to form NO hemoglobin, but that in the presence of an acid the nitrite is reduced to nitric oxid, which acts upon the hemoglobin to form a stable red coloring matter, NO hemoglobin.

In order to ascertain whether a nitrite had any action upon the hemoglobin of blood, samples of fresh steer's blood were treated with small amounts each of KNO_2 and $NaNO_2$ and placed in a refrigerator, but even after the samples had stood for several days in no case did the nitrite act upon the hemoglobin to form a red coloring matter. The blood turned a chocolate-brown color immediately on adding the nitrite, and gave no colored extract of NO hemoglobin with ether. On acidifying the blood with a few drops of acetic acid so as to decompose the nitrite a red-colored extract of NO hemoglobin was obtained.

These results show very plainly that a nitrite when added to meat having an alkaline reaction, or to blood that is naturally alkaline, has no action upon the hemoglobin to produce a red coloring matter, due to the fact that the nitrite is not reduced to nitric oxid. However, in the presence of a reducing agent, such as the natural acid of the meat, nitrites are reduced to nitric oxid, which acts upon the hemoglobin to form NO hemoglobin.

The action of a nitrite upon hemoglobin to produce a chocolate-brown color, as has been noticed when a nitrite was added to blood or meat, has been ascribed by Gamgee to the production of nitrite oxy-hemoglobin, while most observers have considered it to be the methemoglobin of Hoppe-Seyler. Wood [7] states that according to Haldane, Makgill, and Mavrogordato the new compound is really a mixture of nitric-oxid hemoglobin and hemoglobin. It has been the writer's experience, however, that no ether extract of NO hemoglobin could be obtained from meat or blood to which a nitrite had been added unless the nitrite was first reduced to nitric oxid. This brown color produced by the action of nitrites upon hemoglobin is not necessarily permanent, as in the case of a nitrite added to meat the sample at first took on a chocolate-brown color, but in a short time the meat where not exposed to the air resumed its natural color.

SPECTROSCOPIC IDENTIFICATION OF NITRIC-OXID HEMOGLOBIN.

The spectroscope is of the greatest value in the identification of hemoglobin and its various derivatives; in fact, it is through the use of this instrument that the discovery of many of the hemoglobin derivatives has been made possible.

According to various authorities NO hemoglobin exhibits a well-defined spectrum consisting of a fairly heavy band just at the right of the D line and a faint band just at the left of the E line. This spectrum, it will be noticed, occupies the same position as that of oxyhemoglobin and of carbon-monoxid hemoglobin, the difference being that the spectrum of NO hemoglobin is unaffected by reducing agents, and that the bands are much lighter and less distinct than those of oxyhemoglobin.

An ether solution of NO hemoglobin as prepared in this laboratory by passing nitric oxid into steer's blood and then extracting the blood with ether gave the following spectrum: (1) A very distinct and fairly heavy band just at the right of the D line, corresponding to the wave lengths 5890–5635; (2) a fainter, yet fairly distinct band at the left of the E line, corresponding to the wave lengths 5420–5330. The width and intensity of the bands depend, of course, upon the concentration of the solution of the color. The second band is not always visible, especially in dilute solutions. The bands are not affected by adding to the extract potassium ferricyanid or potassium nitrite.

The red-colored alcoholic or ether extract obtained from various meats which had been cured with saltpeter, such as dried beef, corned beef, summer sausage, pork hams, etc., all gave the above-mentioned characteristic spectrum of NO hemoglobin. The band at the right of the D line was always distinct, but the band at the E line was not always visible unless the solution was quite concentrated. The bands were not affected by the addition of reducing agents. Likewise the

red-colored ether extracts of NO hemoglobin, obtained in the various previously mentioned experiments conducted in this laboratory, all gave the characteristic spectrum of NO hemoglobin. The spectra of these various extracts were identical, whether the NO hemoglobin was formed directly by passing nitric oxid into fresh blood, or indirectly by the reduction of saltpeter to nitrite and nitric oxid in the presence of naturally acid meat, or by the addition of a nitrite to blood, together with a small amount of acid. The spectroscopic identification of this color as NO hemoglobin seems to verify the conclusions already drawn in this paper regarding the action of saltpeter upon the coloring matter of meat.

The spectroscopic identification of NO hemoglobin in a mixture with oxyhemoglobin and hemoglobin, such as exists in a sample of blood into which nitric oxid has been passed, is not easy, owing to the presence of the oxyhemoglobin spectrum which completely obscures that of the NO hemoglobin. The addition of reducing agents does not make the task easier, owing to the presence of the hemoglobin spectrum. However, an ether extract of the NO hemoglobin is free from the other derivatives of hemoglobin, except perhaps hematin, and its identification is comparatively easy.

CHANGES WHICH SALTPETER UNDERGOES IN THE PRACTICAL CURING OF MEATS.

The results of experiments conducted in this laboratory upon the action of saltpeter as a flesh-color preservative have been borne out by observations upon the action of saltpeter in the practical curing of meats. In the examination of a large number of samples of beef and pork pickle taken from the vats in which meat was being cured, it was found that all samples containing saltpeter also invariably contained nitrites. It may be stated, on the contrary, that nitrites were not found in samples of pickle or meat which contained no saltpeter. Since meats, whether in pickle or dry (as in the case of sausage), are acid in reaction, the reduction of the nitrite to nitric oxid and the subsequent action of the nitric oxid upon hemoglobin are readily understood.

Meats cured by the use of saltpeter as a rule give up an extract of NO hemoglobin to various solvents. Ether seems to be the best solvent, but ethyl and methyl alcohol also extract the color. Certain classes of meats contain much larger amounts of NO hemoglobin than others and hence give it up more readily to solvents.

In the curing of meats in a pickle containing salt, saltpeter, and sugar, the action of saltpeter as a flesh-color preservative is quite simple. The reduction of saltpeter to potassium nitrite and the subsequent formation of nitric oxid, which acts upon the hemoglobin, take place very soon after the meat has been placed in the pickle, and

the action continues throughout the process of curing. The same action takes place when meats are " dry cured " by rubbing a mixture of salt, saltpeter, and sugar into the meat.

In the manufacture of sausage saltpeter plays an important part as a flesh-color preservative, and skilled sausage makers handle their product so as to get a maximum development of color. Fresh sausage, such as bologna and frankfurters, are made as a rule partly from trimmings cured with saltpeter, or in case no cured trimmings are available saltpeter is added to the meat after it has been run through the grinder. After the addition of the saltpeter it is customary to allow the product to stand in trucks for several hours or over night in the sausage room before stuffing, and in the case of frankfurters it is also the practice of some sausage makers to allow the sausage after being stuffed in the casings to stand over night in a cooler before being put into smoke. This practice is followed in order to bring out the color in the sausage. In case the sausage meat is ground and immediately packed in casings and put into smoke, the color of the product is not nearly so satisfactory as when the above-mentioned process is followed.

In the manufacture of summer sausage or dry sausage, saltpeter plays a more important part in color production than in the case of fresh sausage. Summer sausage may or may not be smoked, but the principal part of the cure is effected by hanging the product in dry, well-ventilated rooms which are kept at an even temperature. The sausage may be cured in less than a month, but many varieties are cured for as long as sixty to eighty days. In case the sausage is first smoked before going into the drying rooms, the smoking is done at a low temperature. Saltpeter is used in practically all summer sausage, and the conditions of curing are such as to cause a maximum reduction of saltpeter to nitrites and nitric oxid, and hence the formation of a large amount of NO hemoglobin. The color in well-cured summer sausage is so bright as to lead one to think that the product is artificially colored. Such sausage yields very readily to ether a deep-red extract of NO hemoglobin. When ethyl alcohol is used as a solvent the color separates with the fat, to which it gives the same bright color.

AMOUNT OF SALTPETER NECESSARY TO OBTAIN THE MAXIMUM COLOR EFFECT.

Since saltpeter acts upon the hemoglobin in the curing of meats only through being broken down into potassium nitrite and nitric oxid, it is evident that, in so far as the preservation of color is concerned, any saltpeter remaining in the meat after the cure has been completed is so much wasted. The ideal quantity to be used is such that practically no saltpeter, as such, will remain in the cured product.

The writer has examined samples of summer sausage which gave no reaction for saltpeter, or in some cases only a very slight one, and yet this agent had been used in the manufacture of the sausage. The samples all showed, however, the presence of nitrites resulting from the decomposition of saltpeter. The samples of sausage all had a bright red color equal or superior to that of other samples in which considerably larger amounts of saltpeter had been found. The exact amount of saltpeter necessary to be used in the curing and preparation of the various meats in order to produce the desired color in the product remains to be determined by practical experiments in the preparation of such products.

The use of excessive amounts of saltpeter in the curing of meat or in the manufacture of sausage acts very injuriously upon the quality of the product. In the case of summer sausage where too large an amount of saltpeter has been used the product often turns a dark-brown or chocolate color throughout, and the meat becomes pitted and filled with air holes. In such a case practical sausage makers state that the saltpeter has burned the meat. Dr. S. E. Bennett, inspector in charge at this station, had several lots of summer sausage manufactured, in which amounts of saltpeter ranging from 2 to 10 ounces per 100 pounds of meat were used, and the product was cured in the usual manner. Where a larger amount of saltpeter than 2 ounces per 100 pounds was used the product turned dark brown in color and was pitted or contained numerous air holes. The following table shows the amount of saltpeter and nitrites present in the sausage when cured, as compared with the amount of saltpeter originally added to the product:

Effect of adding varying amounts of saltpeter in curing of summer sausage.

Sample No.	Saltpeter (KNO_3) added to 100 pounds of meat.		Per cent of saltpeter (KNO_3) found.	Per cent of nitrites (KNO_2) found.
	Ounces.	Per cent.		
1	None.	None.	None.	None.
2	2	0.125	None.	0.004
3	4	.250	0.086	.0144
4	6	.375	.120	.0269
5	8	.500	.300	.0448
6	10	.625	.460	.0404

It will be noticed that in the case of sample No. 2, where 2 ounces of saltpeter were added to 100 pounds of meat, no saltpeter, and only a very small amount of nitrites, was found in the cured product. This disappearance of saltpeter is due to a partial reduction of the saltpeter to nitrite and nitric oxid, and possibly to a union between the saltpeter and the meat proteids. The dark-brown color of samples

Nos. 3, 4, 5, and 6 in contrast to the bright-red color of sample No. 2 is undoubtedly due to the action upon the hemoglobin of the considerable amount of nitrites present. The pitted condition of the sausage is probably due to the action of the nitric oxid formed, in its effort to escape. Samples Nos. 5 and 6 gave a slight odor of nitrogen dioxid.

Practical curers of meat find that when an excessive amount of saltpeter is used in the dry curing of meat the lean portion turns a dark-brown color. Where excessive amounts of saltpeter are used in the curing of beef hams in tierces it has often been noticed by the cellar men that on opening such a package a distinct and often very strong odor of gas was present. The writer has examined numerous tierces of beef hams and samples of sausage in which excessive amounts of saltpeter had been used, and has found the characteristic odor of nitrogen dioxid, and has also been able to identify this gas positively. The nitrogen dioxid undoubtedly results from the oxidation of the nitric oxid formed by the reduction of the nitrites.

In conclusion, the writer's thanks are extended to Dr. S. E. Bennett, inspector in charge of the Federal meat inspection at Chicago, for many helpful suggestions in carrying out the investigations reported in this paper.

CONCLUSIONS.

The action of saltpeter as an agent in influencing the color of salted meat may be summarized as follows:

1. The red color of uncooked salted meat to which saltpeter has been added as a preservative agent is due to the presence of NO hemoglobin.
2. The NO hemoglobin is formed by the action of nitric oxid on hemoglobin.
3. The nitric oxid is formed by the reduction of the nitrites within the meat.
4. Saltpeter is reduced within the meat to nitrites, the reduction taking place equally well in either an acid or an alkaline medium.
5. Saltpeter as such has no action as a flesh-color preservative.
6. Nitrites as such have no action in preserving the natural color of meat.
7. The brown color produced in meats cured with an excessive amount of saltpeter is due to the action of nitrites upon the hemoglobin.

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NOTES ON THE ANIMAL INDUSTRY OF ARGENTINA.

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INTRODUCTORY.

An appointment as one of the delegates of the United States to the First Pan-American Scientific Congress, held at Santiago, Chile, December 25, 1908, to January 5, 1909, gave the writer an opportunity to spend a few weeks in Argentina, to see something of the animal industry of the country, and to become acquainted with a few of the leading breeders. On account of the immensity of the country and the great distances to be traveled, a complete stranger can no more gain a really comprehensive idea of the live-stock business in the Argentine Republic in six weeks than he could of that of the United States in the same time. Argentina is not so large in area as the United States, but travel by rail is not nearly so rapid, nor is the country so well provided with rail communications. When one considers that Argentina has an area of over 1,000,000 square miles, on which there is a population of probably not more than 6,000,000 persons, over 1,000,000 of whom live in the capital city, one can appreciate somewhat how little the interior of the country has been developed.

Buenos Aires may be reached in about twenty-five days from New York direct, or in twenty-eight or thirty days via Southampton or Cherbourg. If the traveler is pressed for time, he will find the direct route available twice a month; if comfort en route is a consideration, the journey via Europe is preferable and weekly sailings are available. There is no great difference in cost between the two routes, the direct one being somewhat cheaper unless the exclusive use of a stateroom is engaged. The writer sailed from New York on October 7, 1908, going via England and arriving at Buenos Aires on November 7, exactly one month from the day of sailing.

THE MEAT TRADE OF ARGENTINA WITH ENGLAND.

Everyone knows in a more or less hazy fashion that Argentina is a great factor in the meat trade of Great Britain; few persons realize, however, the tremendous growth of the industry and especially the increase in the shipments of refrigerated (chilled) beef to England from the River Plate ports, all of which, the writer believes, comes from Argentina. This business is the result of only eight years' growth.

Prior to 1901 all the beef exported was frozen, and the real development of the frozen beef trade began only a year or two before. In the year mentioned 24,919 quarters of chilled beef went from the River Plate to England; the next year, 94,498 quarters; in 1903, 142,542 quarters; in 1904, 198,300 quarters; in 1905, 402,195 quarters, the amount not subsequently exceeding 500,000 quarters until 1908, when 767,284 quarters were exported.[a]

Of course it is much more expensive to ship chilled beef than to ship it frozen, but a difference of 2 cents a pound or more in the price makes chilling worth while. The exports of chilled beef are not replacing those of frozen beef, however, as the latter have increased more than three times during the same period. The exports of frozen beef for the eight years in question were as follows:

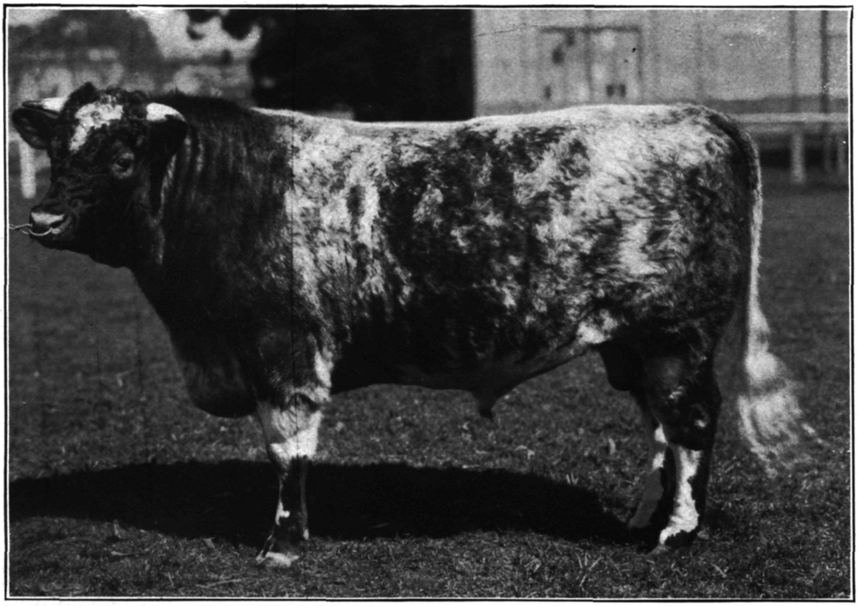
Year.	Quarters.	Year.	Quarters.
1901	440,864	1905	1,168,133
1902	488,876	1906	1,314,703
1903	565,642	1907	1,321,110
1904	789,109	1908	1,533,357

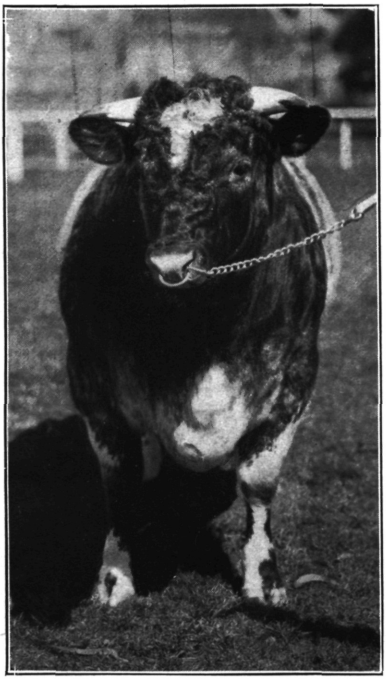
During this time the trade with New Zealand and Australia has fluctuated in amount with a strong tendency to decrease. The exports of frozen beef from River Plate ports to Great Britain for the year 1908 alone exceed all such exports from New Zealand and Australia for the seven years from 1902 to 1908.

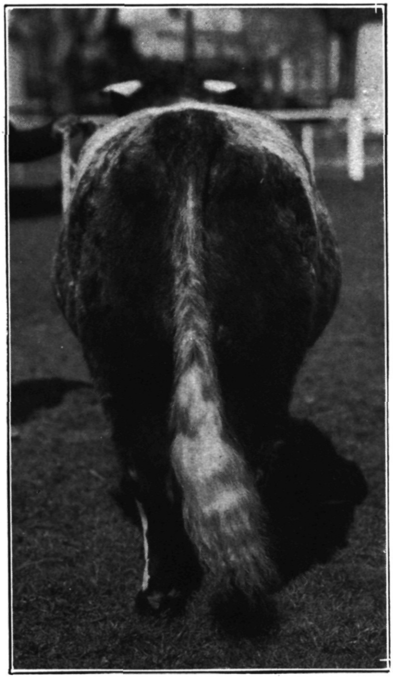
Frozen beef can not compete with chilled beef, and therefore North American cattle growers have little to fear in the growth of the River Plate frozen-meat trade. Although the British quotations show that River Plate chilled beef is inferior to chilled beef from the United States, the opinion of exporters at Buenos Aires and other slaughtering points is that the quality is improving, although the quotations may not yet show it. However, with the marked falling off in our own exports[b] of meat and meat products, we can well find it worth while to watch the progress of the energetic young nation to the south of us, whose stock of cattle is nearly five head per capita of population. If our export meat trade is about to repeat the history of our export horse trade, and the home consumption account for practically the entire supply, our breeders will have in South America a great opportunity to market superior breeding animals. If rising prices in the United States force us to abandon our foreign meat trade to a country which is now a rival in that trade, there is no reason why that rival should not be made a friendly customer for bulls and rams.

[a] These and other figures regarding the meat trade between the River Plate and Great Britain are taken from W. Weddell & Co.'s (London) Review of the Frozen Meat Trade for 1908, Supplement No. 1.

[b] See page 404 of this report.







OXFORD BARON 14TH (13397).

Champion Shorthorn bull at Argentine Rural Society's show, Palermo, Buenos Aires, September, 1908. Calved October 7, 1906. By Oxford Baron; dam Orange Blossom 46th.

FIG. 1.—CHAMPION LINCOLN RAM AT ARGENTINE RURAL SOCIETY'S SHOW, SEPTEMBER, 1908. LAMBED AUGUST 1, 1907. SIRED BY AN IMPORTED RAM; DAM BRED IN ARGENTINA.

FIG. 2.—CHAMPION RAMBOUILLET RAM AT ARGENTINE RURAL SOCIETY'S SHOW, SEPTEMBER, 1908. LAMBED APRIL 8, 1906.

JUDGING SHORTHORN BULLS AT A SHOW OF THE ARGENTINE RURAL SOCIETY.

LIVE-STOCK CENSUS OF ARGENTINA.

The live-stock census of Argentina was taken in 1908. It was the first of its kind since 1895, and is believed to be the most accurate yet taken. The methods used were modeled after those of the United States and were well thought out; the enumerations appear to have been carefully made. The following figures are taken from the preliminary report of the director, which was made in November, 1908. The values were estimated in consultation with the Argentine Rural Society and may be regarded as conservative.

Number and value of the live stock in Argentina according to 1908 census.

Species.	Number.	Value.
		Pesos.[a]
Cattle	29,116,625	938,685,834
Horses	7,531,376	205,836,834
Mules	465,037	22,561,075
Asses	285,088	2,854,950
Sheep	67,211,754	287,359,076
Goats	3,945,086	8,321,839
Hogs	1,403,591	15,672,637
Total value	....	1,481,282,245

[a] The Argentine paper peso (dollar) is worth 11.45 to the pound sterling, or about 43 cents United States currency. All references to money in this article are in terms of the paper peso, unless otherwise specified.

This report shows that the number of cattle in Argentina is hardly half of that of the United States, the number of horses is about one-third, and the number of sheep considerably more. Considering the small population of the country, the number of goats is remarkably large. Although a few herds of hogs are seen, some of which are of excellent quality, Argentina is not in any sense a hog-raising country, and probably never will be. At present there is only a limited demand for pork for home consumption, bacon and ham being decided luxuries. Imported pork products bring very high prices, from 50 cents to $1 gold per pound being the usual quotations for English hams. In a country which serves the "Continental breakfast" universally, where the so-called "breakfast" is a heavy meal at midday and begins with soup and ends with pastry and dessert, where ham and eggs or bacon and eggs are unknown dishes, and where the workingman lives on a diet of beef and bread, the consumption of pork products will never be large. If the hog industry ever assumes any importance in Argentina, an export trade must be built up for it and the quality of the local product greatly improved.

A careful attempt was made during the recent census to estimate the proportion of purebred, grade, and native animals living in May, 1908, with the following interesting results.

Species.	Pure-bred.	Grades.	Natives.
	Per cent.	*Per cent.*	*Per cent.*
Cattle	3.4	51.7	44.9
Horses	.7	22.5	76.8
Sheep	1.8	82.5	15.7

BREEDING FARMS.

The great stock-breeding farms of Argentina are nearly all located within a short distance of the capital, Buenos Aires, on the low, flat lands which form the Argentine section of the valley of the River Plate. The soil is alluvial, of wonderful depth and fertility, the land almost level, and the altitude very little above sea level.

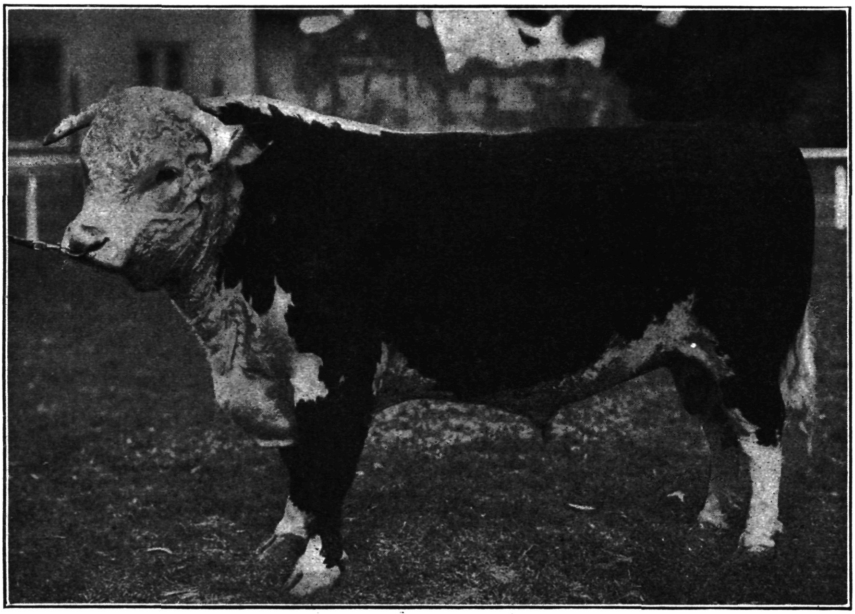


FIG. 39.—Matterhorn 30, R. P. 544 (3193), champion Hereford bull at the Argentine Rural Society's show, September, 1908. Calved April 28, 1905. By Matterhorn; dam Sabina.

From the River Plate there is a small but sudden rise which carries the land above flood line, and from this rise one can look for miles away from the stream with only the horizon to break the view. Nothing in Kansas or Nebraska can compare with the pampas of Argentina for flatness. The rainfall around Buenos Aires is ample to grow wonderful grass and magnificent trees, but as one goes west toward the Andes the rainfall diminishes. As a rule, however, the water table is near the surface even in the semiarid regions.

Buenos Aires Province, especially in the eastern portion, is a vast grazing ground. Very little of the land has been broken up except near the capital and the towns. The native grasses are depended on

almost entirely. It is an ideal pasture country; cattle thrive summer and winter on no feed but grass, and very little shelter is required. Except when fitting stock for show or sale, no grain is fed; but when stock is being so fitted no expense is spared to put the animals into the best condition. The competition in the show ring is exceedingly keen, and even as early as November, 1908, cattle were being fitted for the show of 1910.

Being a land of luxurious pasture, this is an ideal country for Shorthorn cattle and Lincoln sheep. The great majority of the cattle are Shorthorns; Herefords are used only on pastures that are naturally poor or which have been overstocked. In the north, in the provinces of Corrientes and Entré Rios, Aberdeen-Angus cattle are comparatively common; they appear to thrive there as well as they do in our own Southern States. With the average ranch owner, however, Aberdeen-Angus cattle are not especially popular, although some packing-house managers have urged their use. Little corn is fed to stock and most of the steers are sold for slaughter directly off grass, just as our western cattle are marketed and the export cattle from the bluegrass pastures of southwestern Virginia and western North Carolina.

In the west the great alfalfa "camps" are one of the wonders of the country. Whole ranches are sown to alfalfa, and it is not at all uncommon to see tracts of 40,000 to 50,000 acres entirely in alfalfa. They even tell of landowners who are sowing from 65,000 to 85,000 acres in this legume. Nearly all the alfalfa is pastured by horses, cattle, and sheep, and few losses result.

The impression one gets from visiting these establishments is that of physical vastness and immense resources. With it all, however, there is an attention to business details that is surprising, and labor-saving devices are common.

SAN JUAN.

The first estancia (stock farm) visited was San Juan, located south of Buenos Aires, within an hour's ride of the city. It has been in the hands of the same family for many years, the present owner being the grandson of the original owner. The history of the estancia covers a period of more than fifty years, and during all this time Shorthorn cattle of the highest type have been bred. Within comparatively recent years Herefords have been added, and the owner is fully as proud of his Herefords as he is of his Shorthorns. Unfortunately time did not permit a careful examination of the Herefords, but the writer's impression of them, as seen in the field, was that they are animals of good quality, good size, and full fleshed, and that they would compare favorably with those bred in the United States. The Shorthorn cows on this estancia are excellent—much better, in fact,

than the bulls. It is doubtful if any Shorthorn breeding farm in the United States can show a better collection of large, thick-fleshed cows of quality and finish than the San Juan estancia.

The work done at San Juan differs markedly from that carried on at many other breeding farms, in that the owners have bred for a type with greater perseverance and consistency. They have, it is true,

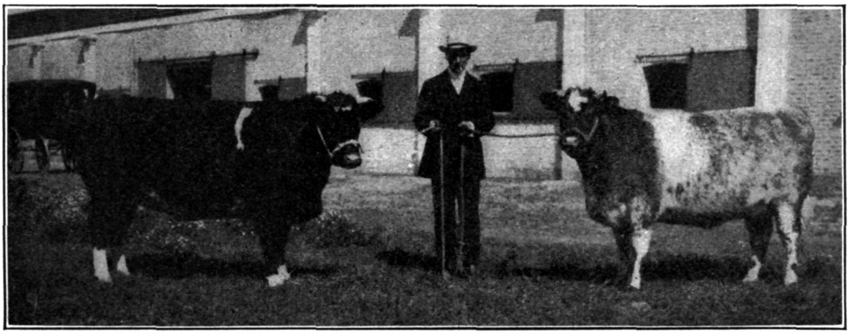


FIG. 40.—Two-year-old heifers by True Blue at San Juan estancia. (Original.)

gone to England to a great extent for their bulls, but their cows have generally been bred on the estancia. The cow Mantalini 17 (Pl. X, fig. 1), was bred on the estancia, as were her dam (Pl. X, fig. 2) and granddam. The dam of this cow is still living, and the illustrations show three generations of a remarkable family of which any breeder in any country might well be proud. The two San Juan heifers

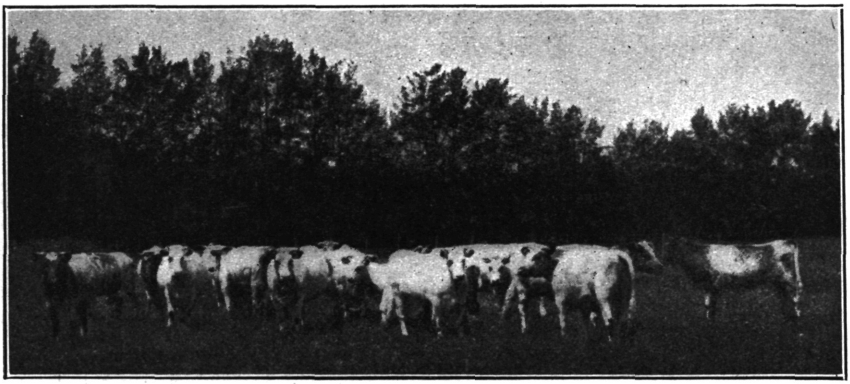


FIG. 41.—Shorthorn heifers at San Juan after a winter on pasture. (Original.)

illustrated (fig. 40) show that the Mantalini family is not an exception on this estancia, and at the time these two were photographed there were others bred there which were very nearly as good.

SAN MARTIN.

The San Martin estancia is located about one hour's ride southwest of Buenos Aires and comprises 9 square leagues of land (60,000

CATTLE IN PENS AT A SHOW OF THE ARGENTINE RURAL SOCIETY.

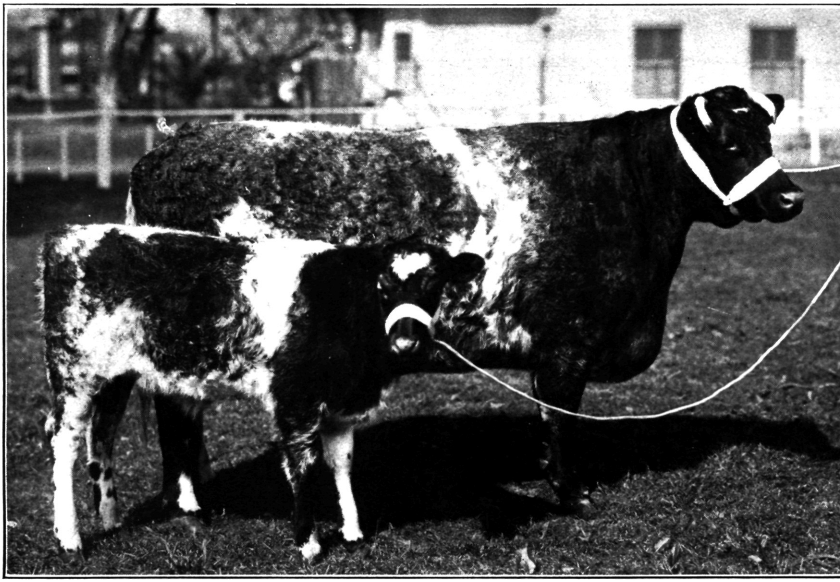
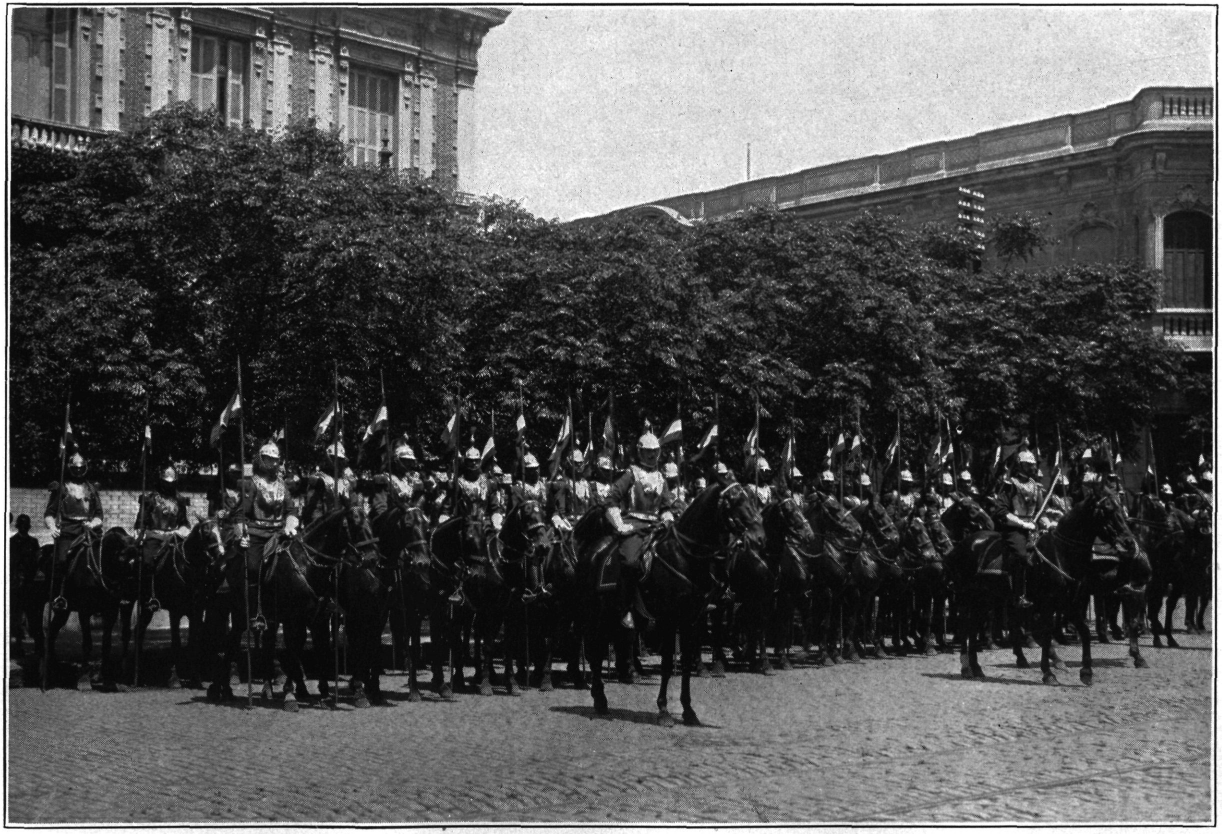


FIG. 1.—MANTALINI 17, CHAMPION SHORTHORN COW AT ARGENTINE RURAL SOCIETY'S SHOW, SEPTEMBER, 1908. CALVED AUGUST 26, 1904. BY CONQUEROR'S CROWN; DAM MANTALINI. CALF AT SIDE BY TRUE BLUE.

FIG. 2.—MANTALINI, THE DAM OF MANTALINI 17. CALVED AUGUST 16, 1901. BY FARRIER; DAM MANTALINI 3. PHOTOGRAPH TAKEN IN NOVEMBER, 1908, AFTER THE COW HAD BEEN THROUGH THE WINTER ON PASTURE ALONE. NOTE HER EXCELLENT CONDITION. (ORIGINAL.)



A TROOP OF LANCERS IN THE ARGENTINE ARMY, MOUNTED ON NATIVE HORSES.

acres). Hackney horses and Shorthorn, Holstein, and Red Polled cattle are bred, but the most interesting feature of this estancia is the large dairy in connection with it. The dairy is known as "La Martona," and is one of the best and largest in the neighborhood of Buenos Aires. It maintains stores throughout the city where its products are sold. At the time of the writer's visit the manager stated that they were using 150,000 liters (39,600 gallons) of milk daily, two-thirds of which was produced upon the estancia. None of the cows are sheltered at any time or given any feed in addition to pasture. They are milked in corrals after the usual rather careless Argentina custom, and the milk is sent directly to the dairy. Nearly

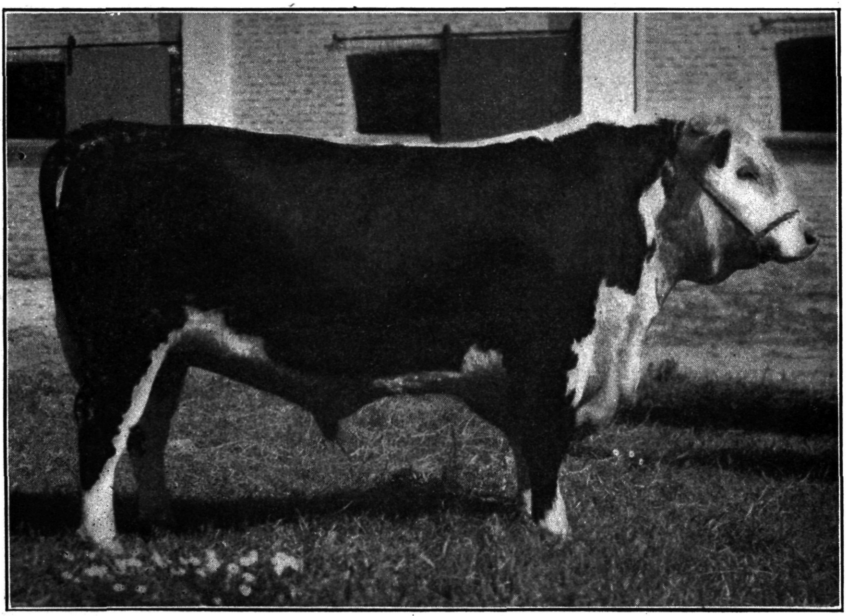


FIG. 42.—Hereford bull Ben Tomkins (3448). Calved July 24, 1907. By Campaigner; dam Quilmes Fortune. At San Juan estancia. Photographed November, 1908. (Original.)

all the milk is pasteurized. This dairy makes a specialty of milk for feeding infants, sterilized milk, "dulce de leche" (milk marmalade, very much like caramel), and casein. A few pigs are fed on buttermilk. An extensive condensed-milk plant is now being put in. Sterilized milk is put up in half-liter sterilized bottles and sealed with a tin cap like that used in this country in bottling ginger ale, beer, and similar beverages.

The San Martin estancia is especially interesting as showing the evolution in management which has taken place in Argentina, especially in the vicinity of Buenos Aires, where the land has increased in value to a rather high point. This increase in the price of the land

has made necessary the formulation of systems for developing all possible sources of revenue, and instead of letting the cow run the year round without any return except her calf, the possible milk yield from the cow is utilized. San Martin is a great dual-purpose cow plant, and the success of the enterprise is an indication of what might be done on some of the North American ranches if means could be obtained economically to milk the cows.

LA BELEN.

La Belen estancia is noted for its Lincoln sheep and Shorthorn cattle. It comprises about 37,000 acres of land and employs 250

FIG. 43.—Hereford heifer Toluca 25 (3425). Calved November 26, 1906. By Baron; dam Toluca 5th. Photographed November, 1908. (Original.)

men. There are 13 large barns on the place, in which the cattle and sheep are kept which are being especially fitted for show and sale, in addition to as many more smaller ones. The large barns cost 20,000 pesos each. The construction of one of these barns is unique. It is raised on posts, about 30 inches off the ground, and has three entrances—at one end and in both sides at the middle. There is a double row of stalls on either side of a wide passageway. The floor is slatted, and the whole barn is thoroughly flushed out with water at frequent intervals. The structure is only one story, but the roof is high, and there is the freest possible circulation of air.

The estancia is under an excellent business management, and the assistant manager is authority for the statement that unless sales exceeded 1,000,000 pesos annually they would not meet expenses.

Ordinary rams for range use bring from 200 to 500 pesos, and bulls for the range from 400 to 1,000, and in some cases as high as 1,700 pesos. There are 4,000 cows on the estancia, all of which are the descendants of purebred Shorthorns, but only 400 of them are registered. About 200 bulls were on hand. Nearly all of the stud bulls have been

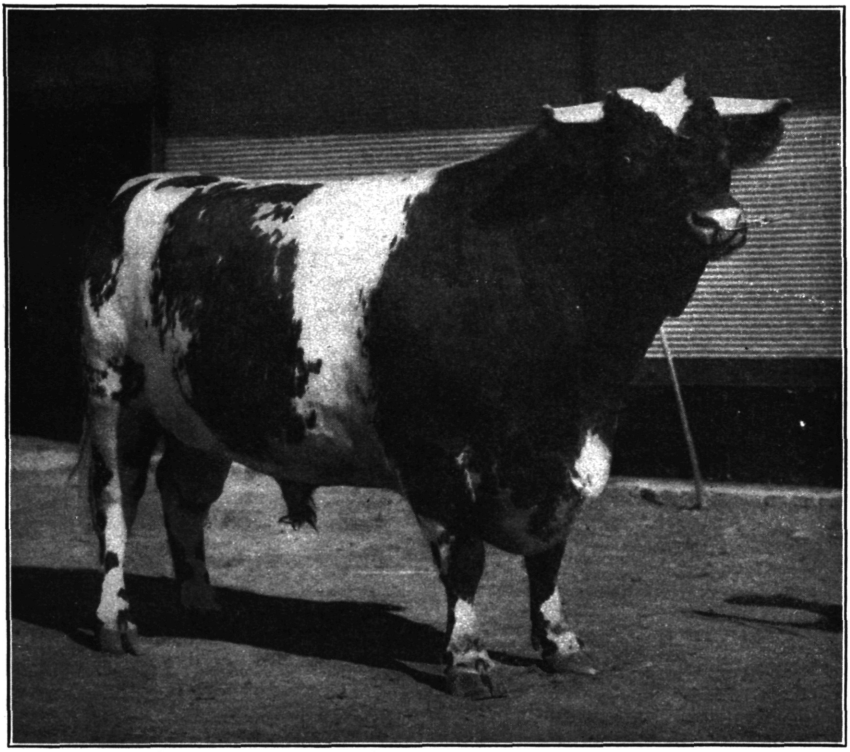


FIG. 44.—Shorthorn bull Polikao 2d at 7 years of age. Champion bull at the Rural Society's show in 1905. Purchased for Las Acacias estancia for 40,000 pesos. Weight when photographed (November, 1908) 2,700 pounds. (Original.)

imported, and as much as 30,000 pesos has been paid for one bull. A few pigs are kept on the place.

LAS ACACIAS.

Las Acacias estancia is located near the San Juan estancia. It is owned by an incorporated company, and the evidence of business sagacity and system is everywhere apparent. It is famous for its Rambouillet sheep, and some very good Shorthorn cattle and Berkshire hogs are to be seen there. The estancia is small, compared with

most of the others, comprising about 10,000 acres. Merino sheep have been raised there ever since 1823. The original stock was similar to

FIG. 45.—Berkshire hogs at Las Acacias. (Original.)

the original Merino stock in North America, on which has been grafted Rambouillet blood from France and Germany. The sheep are now known as Argentine Rambouillets, and the flock is main-

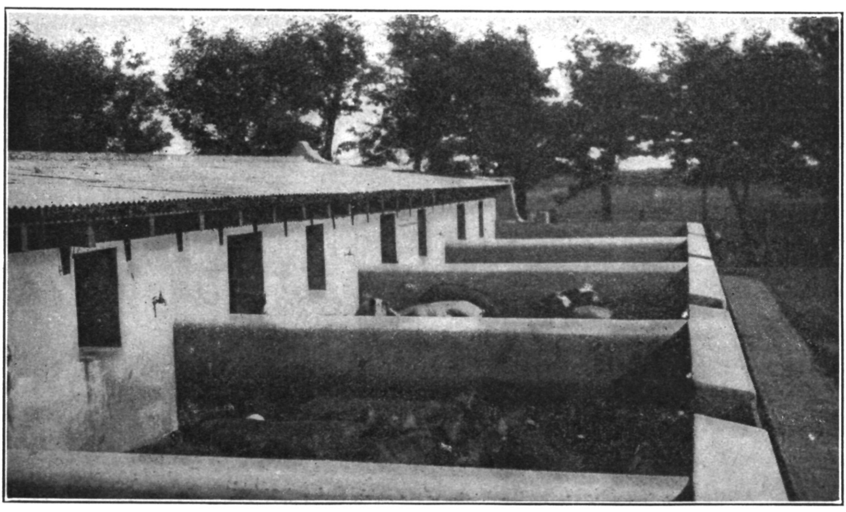


FIG. 46.—Hog pens at Las Acacias. (Original.)

tained in seven families. There are 700 breeding ewes, 100 in each family. No outside animals are bought, but the blood lines of the different families are used in such manner as to prevent extreme in-

breeding. The distinction between families appears to be more a matter of type than of blood lines, and the family characteristics are based principally on differences of fleece, although form is considered to a certain extent.

This was one of the first estancias in Argentina to take up hog raising. There are quite a number of purebred Berkshires, but most of the hogs are crosses of Berkshire on natives. About 3,000 hogs are kept, and sales number about 1,000 annually. They bring from 40 to 45 pesos each. All the pens are concrete and can be easily flushed out or disinfected if necessary.

The estancia is now preparing to install its own slaughterhouse and cure its own hams and bacon. A native Spaniard has been engaged for this work. The cattle are, of course, Shorthorns, and are valued

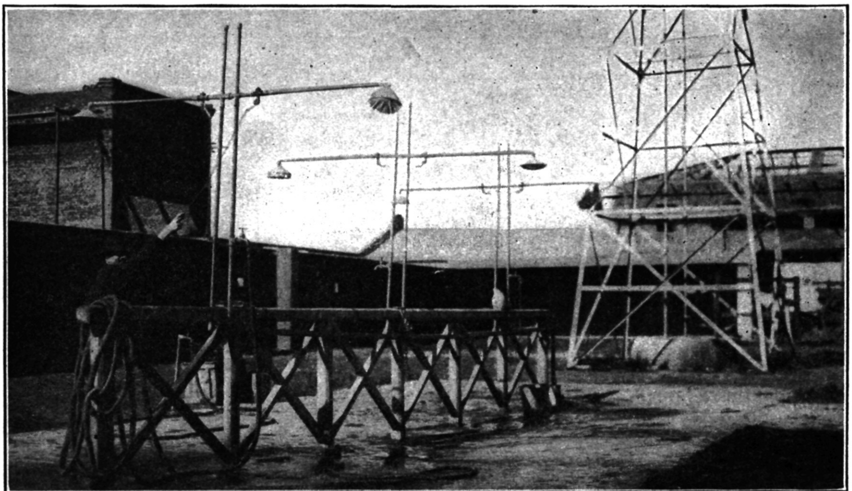


FIG. 47.—Shower baths for cattle at Las Acacias. Note manner of operation. (Original.)

at a total of 2,200,000 pesos. The bulls are especially good, and the barns for housing the cattle are among the best that the writer saw. The barns are arranged in the form of a quadrangle, one side of which contains the feed house and sleeping quarters for the men. The fronts of the stalls are sliding doors of corrugated iron, and the doors are kept open most of the time. This arrangement enables the cattle to be practically in the open air. Inside the quadrangle are a well, windmill, and tank, and a series of shower baths, six in number, which are used when fitting cattle for show. Each shower is controlled by a separate valve, and a concrete pavement around the bath prevents mud (see fig. 47).

Gardening is quite an extensive feature of this estancia. The flower beds, roses, greenhouses, and vegetable gardens are very beautiful. A double row of crimson rambler along the drive back of the mansion

was a most beautiful floral display. The gardening is under the charge of a graduate of the horticultural school of Turin.

SAN JACINTO.

San Jacinto estancia is located about two hours' ride due west of Buenos Aires, and is noted for its Thoroughbred horses and Shorthorn cattle. A few Jersey cattle are kept. Some mules are bred and a large number of sheep are raised, principally for the meat market. There are 20,000 cattle in all, and 35,000 sheep. The owner of this estancia is peculiar in his attitude toward pedigrees. He keeps no pedigrees whatever of his cattle or sheep, and although all his cows are at least very high grade Shorthorns, and a great many of them practically purebred, he enters only the classes for grades and crosses at the shows.

FIG. 48.—The sheep barn at Las Acacias. Sheep in foreground are some of the breeding ewes in the flock. (Original.)

The Thoroughbreds on this estancia are among the best in Argentina, and it goes without saying that the same system regarding pedigrees used with the cattle would not be possible with the Thoroughbreds, on account of the rules of the racing commission of the Jockey Club. The leading stallions are Bat and Val d'Or (fig. 49) both well known in racing circles. Bat is a beautiful horse, rather small, but full-made, with a great deal of quality. His colts have not been very successful on the turf, although they are uniform in appearance and have excellent conformation. From the standpoint of individuality Bat's progeny are superior to those of Val d'Or, but the latter, which is a son of the famous Flying Fox, is the better racing sire. One million francs ($193,000) were paid for Val d'Or. He is a big, almost coarse, horse, with a good top line. His colts lack the uniformity of

Bat's but the best ones are far superior. The mares on this estancia compare very favorably with those seen on the better stock farms of Kentucky.

CHAPADMALAL.

Chapadmalal estancia is located 12 miles from Mar del Plata, the seaside resort of Buenos Aires, a night's ride from that city. The estancia comprises 10 square leagues of land (about 67,000 acres), and has a frontage of 12 miles on the sea. It has been developed along the lines of the great estates of England, and the influence of England on its owners is marked at every turn. The mansion was designed by an English architect, and all the wood and furniture

FIG. 49.—Thoroughbred stallion Val d'Or, at San Jacinto. (Original.)

used were imported from England. Englishmen are found everywhere in charge of the animals. The estancia aspires to be a sort of general supply house for all kinds of breeding stock. Almost every sort and breed of horse is raised except the American Trotter and American Saddle Horse. Hackneys, Shires, Cleveland Bays, English hunters, English polo ponies, and even Morgans are shown the visitor. The Hackneys are very good indeed, and the owner is fitting them for the coaching run from London to Brighton. Hopwood Viceroy, the Hackney champion at the 1908 Olympia show at London, was seen and photographed. He was in excellent condition after his long sea voyage, and is a horse which should be of great value in his new home.

The Shorthorn cattle on this estancia are fair in quality, and the Lincoln sheep are magnificent. The establishment vies with La Belen for first honors in the Lincoln classes at the great shows.

FIG. 50.—Thoroughbred mares and foals at San Jacinto. (Original.)

Considerable farming is done at Chapadmalal. About 1,000 acres are sown annually in oats, wheat, corn, peas, and mangel-wurzels.

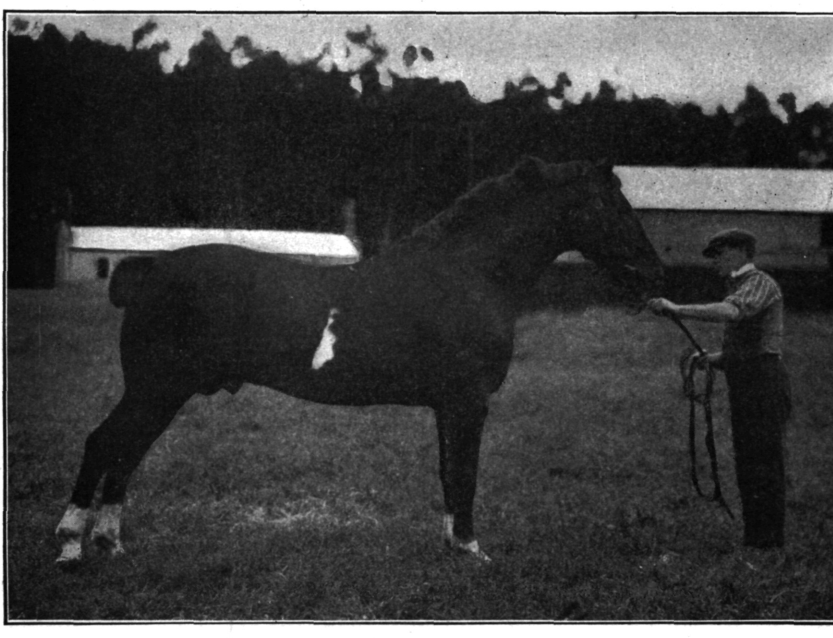


FIG. 51.—Hackney stallion Hopwood Viceroy 9280, E. H. S. B. First in class for Hackney stallions, over 15.2 hands, foaled in 1904 or before, and winner of Woodhatch champion cup for best Hackney stallion, International Horse Show, Olympia, London, in 1908. Imported into Argentina in 1908 by Sr. Miguel A. Martinez de Hoz, Chapadmalal. Photographed in November, 1908. (Original.)

No land is kept in crops longer than three years in succession. The managers are planning to begin the use of silage and are putting in

a unique system of machinery to prepare the silage. The fodder will be cut in the usual manner and then run into a large grinding machine similar to a sausage grinder, corn-and-cob meal being run in at the same time and mixed with it; the silage mixture will then be conveyed to a pit for storage. The pastures on the estancia differ from those around Buenos Aires in that the grasses are not the native grasses, but such as English rye grass, orchard grass, etc. The pastures are plowed up occasionally and reseeded. This is not an alfalfa country, except in the bottom lands.

MEAT PACKING.

The slaughtering business at the River Plate ports is naturally very extensive, for without the export meat trade the cattle business of Argentina could not exist and the sheep business would be dependent wholly on the wool trade. In contrast with our own system the abattoirs in Buenos Aires are more or less scattered, although all of them are on the Riachuelo, a small navigable stream tributary to the River Plate, which bears much the same relation to Buenos Aires that the Chicago River does to the city of Chicago, and the two streams look very much alike.

None of the plants begin to approach the great Chicago or Kansas City establishments in size or number of slaughterings. A plant with a daily capacity of 500 cattle and 3,000 sheep is a large one. Owing to the small capacity there is not the same demand for labor-saving devices. Very little mechanical traction is used in moving carcasses from the killing floor to the freezing rooms. At one of the leading plants in Buenos Aires the record time for slaughtering a steer from the time he is struck to the time his carcass is started to the cooler was said by the foreman to be 7 minutes, and this was regarded as a good record in other establishments.

The external appearance and surroundings of the plants are usually rendered as atractive as possible, the buildings being painted white and flowers planted in the open spaces near them. The abattoirs themselves are usually quite clean, and little objectionable odor is noticeable.

In general the system of killing is similar to that used in the United States. The electric prod, the long alleyways to the killing pens, the tilting floor, and the butcher with his poleax are familiar sights. In some plants the cattle swim through a long vat or stand for 10 to 15 minutes under a shower to clean the hides, cool the animals, and put them into better condition for killing. One foreman claimed to get as much as $1 gold per 100 kilos (220 pounds) more for hides so treated.

In killing, a common method is to strike the animal a sharp blow with a short, heavy, triangular-shaped knife in the neck just back of the head, which severs the spinal cord and kills at once if the blow is properly directed. The common poleax is also used, and sometimes one that is sharp and hollow at one end and cuts through the skull.

Chilling rooms are kept at 29 to 30° F., and freezing rooms at 14 to 18° F. Carcasses may be put into the freezing rooms at once or

FIG. 52.—A "gaucho." These men bear the same relation to the animal industry of Argentina that the cowboys did in early days to western ranching in the United States. They are splendid horsemen, and the cavalry of the Argentine army is largely recruited from them. Note manner of carrying quirt. A gaucho's wages are 30 to 40 pesos a month, quarters and rations; rations are 5 pounds of meat daily and bread. (Original.)

cooled gradually. They sometimes remain as long as two weeks in the freezing rooms before being put on board steamer. The temperature in the freezing chambers on board ship is kept at about 18° F. Frozen beef is very economically stored on ship, being piled in tiers from the bottom to the top of the hold. Chilled beef must be hung on hooks.

A few "frigorificos" (freezing plants) in Buenos Aires are located so that they can load directly into a steamer's hold, but most of them load first into lighters and reload to the vessels. One of the

largest establishments, with only a short lighter voyage, has installed refrigerating machinery in its lighters, which keeps the temperature the same as that of the freezing rooms in the plant. This is in addition to insulating the lighters thoroughly to prevent radiation of heat. Generally insulation alone is depended upon to prevent thawing of the meat, no special refrigeration on the lighters being thought necessary.

The impression a North American gets is that there is very little utilization of by-products in the Argentine abattoirs. Each plant, of course, has its rendering tanks, but by-products are usually sold in the unfinished state to local factories.

The inspection system seems to be thorough and efficient.

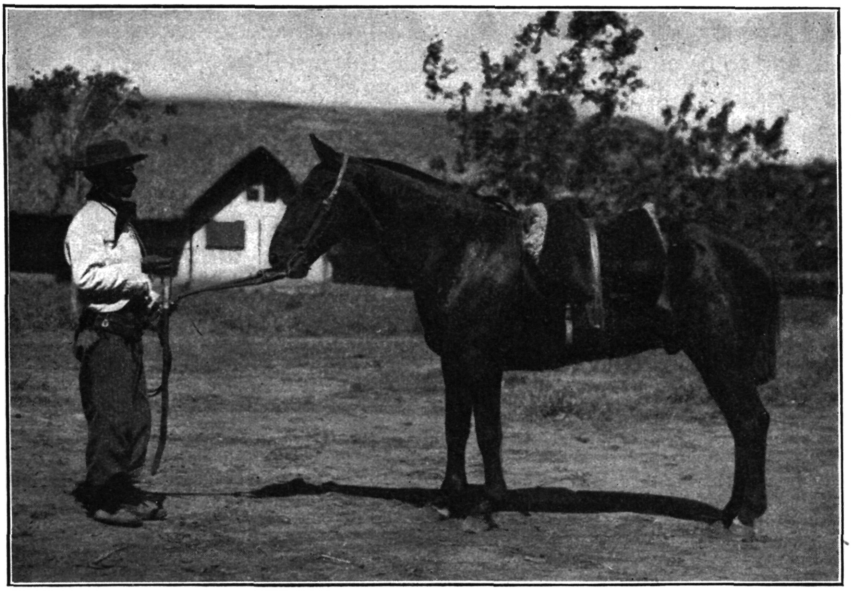


FIG. 53.—A "gaucho" dismounted to show peculiar type of saddle.

OPPORTUNITIES FOR UNITED STATES BREEDERS.

South America, and especially Argentina, has been discussed for years as a promising outlet for the purebred live-stock trade of the United States, but few important efforts have been made to obtain an entrance into that field. An Indiana stockman has for some time been making annual shipments of cattle, hogs, and poultry to Buenos Aires, and the venture has been a profitable one on the whole. The shipment of Thoroughbred horses in the summer of 1908 attracted much attention in both countries, and the horses sold fairly well in Buenos Aires. There is also a New York firm which has sent quite a number of dairy cattle to Brazil, and the trade of the Vermont Merino sheep breeders with Uruguay is still carried on in a limited

way. In nearly all cases, however, the Argentine breeder seems to feel that if he wants something better than he can breed himself, he must go to England or France for it.

The Argentine breeder recognizes the value of North American importations for just about what they are worth. If good animals, they are welcome; if inferior, they meet with no more ready sale than at home. In the writer's opinion the following are necessary and very important steps to take to bring us our share in the South American trade:

1. Let breeders in both countries become acquainted personally. This could not be done better than by having South American breeders attend our leading live-stock shows and assist in the judging. Invitations of this kind would doubtless be cordially received, and would open the way to an exchange of such courtesies as could not fail to be mutually profitable. Nothing strikes one more forcibly in Argentina, Chile, and other South American countries than the sentiment which exists toward the United States, to which Arthur Ruhl has already called attention in The Other Americans. The dominant note is the expression of a desire to become better acquainted. The South Americans are eager to know the North Americans, but they naturally feel that they should be met halfway.

2. A campaign of enlightenment. In addition to having Argentine breeders visit the United States, there should be a determined effort to exhibit North American animals in Argentina. Prizes at the shows, as a rule, are open only to native-bred animals, but that would not prevent the exhibition of animals for advertising purposes and for sale.

If North American breeders should form a company and buy a small estancia where cattle could be kept prior to sale, they could combine this advertising feature with the lowest possible cost of handling the animals.

In this connection it may be remarked that a permanent exhibit of breeding animals in the United States could be of great benefit, not only in developing trade with South America, but with other countries as well.

In developing the trade with Argentina, four points should be especially borne in mind:

1. Only good animals should be sent. Argentine breeders are just as good judges as those in other countries.

2. The best demand exists for beef cattle in the following order: Shorthorns, Herefords, Aberdeen-Angus; for horses, Thoroughbreds and Hackneys; for sheep, Lincolns are by far the most in demand; for hogs, Berkshires and Poland-Chinas, but the hog trade, as already pointed out, is limited.

3. The representative in charge should have a thorough knowledge of Spanish. It is a waste of money to send a business agent to South America who must speak a foreign language or through an interpreter. Even though an Argentine can speak English fluently, he naturally prefers to use Spanish at home. If the North American can speak Spanish, few better introductions are needed.

4. The cost of selling animals in Buenos Aires through the auction stables is considerable. These stables are well fitted up, sanitary, well ventilated and well lighted, and managed by gentlemen with whom it is a pleasure to have dealings; however, they are necessarily expensive, and unless cattle are quickly sold the expenses cut into the profits seriously. If for any reason the prices quoted are not satisfactory, there should be some place where the animals can be kept at a minimum cost until they can be sold to advantage. As before mentioned, a small estancia would be best for this purpose, and could be made a profitable investment in other respects as well.

STATE LEGISLATION REGULATING THE STANDING OF STALLIONS AND JACKS FOR PUBLIC SERVICE.

By Roy A. Cave,
Herdbook Assistant, Bureau of Animal Industry.

Within the past few years eleven different States have passed laws requiring that all owners of stallions or jacks, before standing them for public service, shall obtain a license for each animal from the State board created for that purpose. This board examines all pedigree certificates and veterinarians' certificates of soundness submitted, and enrolls and issues license certificates for all stallions and jacks entitled to such enrollment in accordance with the law. Such legislation has been enacted in Iowa, Minnesota, New Jersey, Pennsylvania, Utah, Wisconsin, Montana, Oregon, Nebraska, North Dakota, and Colorado.[a]

WISCONSIN.

The Wisconsin law, which went into effect January 1, 1906, was the first to be passed, and reads as follows:

The people of the State of Wisconsin, represented in senate and assembly, do enact as follows:

Section 1. Sections 1, 2, 3, 4, 5, 6, 7, 8, and 9, of chapter 116 of the laws of 1905, are amended and made nine sections of the statutes of 1898, to read:

Section 1494–31. Every person, firm, or company using any stallion or jack for public service in this State shall cause the name, description, and pedigree of such stallion or jack to be enrolled by the department of horse breeding of the college of agriculture, University of Wisconsin, and procure a certificate of such enrollment from said department, which shall thereupon be presented to and recorded by the register of deeds of the county in which said stallion or jack is used for public service.

Section 1494–32. 1. In order to obtain the license certificate herein provided for, the owner of each stallion or jack shall make oath before a notary public or any officer duly authorized to administer oaths, that such stallion or jack is, to the best of his knowledge, free from hereditary, contagious, or transmissible unsoundness or disease, or, in lieu thereof, may file a certificate of soundness, signed by a duly qualified veterinarian, who shall be a regular graduate of a recognized veterinary college, or by a registered veterinarian who shows proof that he was in practice in this State for a period of five years prior to the year 1887, and shall make oath to said certificate before a notary public, or any officer duly authorized to administer oaths, and shall forward this affidavit or veterinarian's certificate, together with the stud book certificate of registry of the pedigree of the said stallion or jack, and other necessary

[a] Since this article was written stallion license laws have been passed in Kansas and Illinois.

papers relating to his breeding and ownership, to the department of horse breeding of the college of agriculture.

2. The presence of any one of the following-named diseases shall disqualify a stallion or jack for public service:

Cataract; amaurosis (glass eye); periodic ophthalmia (moon blindness).

Laryngeal hemiplegia (roaring or whistling).

Pulmonary emphysema (heaves, broken wind).

Chorea (St. Vitus' dance, crampiness, shivering, string-halt).

Bone spavin; ringbone; sidebone; navicular disease.

Bog spavin; curb, with curby formation of hock.

Glanders, farcy; maladie du coït; urethral gleet; mange; melanosis; and the department of horse breeding is hereby authorized to refuse its certificate of enrollment to any stallion or jack affected with any one of the diseases hereby specified, and to revoke the previously issued enrollment certificate of any stallion or jack found on investigation by the department to be so affected.

Section 1494–33. The officers of the department of horse breeding of the said college of agriculture, whose duty it shall be to examine and pass upon the merits of each pedigree submitted, shall use as their standard for action the stud books and signatures of the duly authorized officers of the various horse or jack pedigree registry associations, societies, or companies recognized by the Department of Agriculture, Washington, D. C., and shall accept as purebred and entitled to a license certificate as such each stallion or jack for which a pedigree registry certificate is furnished bearing the signature of the duly authorized officers of a Government recognized and approved stud book.

Section 1494–34. The owner of any stallion or jack used for public service in this State shall post and keep affixed during the entire breeding season copies of the license certificate of such stallion or jack, issued under the provisions of the next succeeding section, in a conspicuous place both within and upon the outside of every stable or building where the said stallion or jack is used for public service, at his home or elsewhere.

Section 1494–35. 1. The license certificate issued for a stallion or jack whose sire and dam are of pure breeding and the pedigree of which is registered in a stud book recognized by the Government Department of Agriculture, shall be in the following form:

[University of Wisconsin, College of Agriculture, Department of Horse Breeding.]

CERTIFICATE OF PUREBRED STALLION OR JACK.

No. ———.

The pedigree of the stallion or jack (name) ———.

Owned by ——— ———.

Described as follows: (Color) ———; (breed) ———.

Foaled in the year ——, has been examined at the college of agriculture, and is hereby certified that the said stallion or jack is of pure breeding and is registered in a stud book recognized by the Department of Agriculture, Washington, D. C.

(Signature) ——— ———,
Dean of the College of Agriculture.

2. The license certificate issued for a stallion or jack whose sire or dam is not of pure breeding shall be in the following form:

[University of Wisconsin, Department of Horse Breeding, College of Agriculture.]

CERTIFICATE OF GRADE STALLION OR JACK.

No. ———.

The pedigree of the stallion or jack (name) ———.

Owned by ——— ———.

Described as follows: (Color) ———.

Foaled in the year ——, has been examined at the college of agriculture, and it is found that the said stallion or jack is not of pure breeding and is, therefore, not eligible for registration in any stud book recognized by the Department of Agriculture, Washington, D. C.

(Signature) ——— ———,
Dean of the College of Agriculture.

3. The license certificate issued for a stallion whose sire and dam are purebred, but not of the same breed, shall be in the following form:

[University of Wisconsin, Department of Horse Breeding, College of Agriculture.]

CERTIFICATE OF CROSSBRED STALLION NO. ——.

The pedigree of the stallion (name) ———.

Owned by ——— ———.

Described as follows: (Color) ———.

Foaled in the year ——, has been examined at the college of agriculture, and it is found that his sire is registered in the ——— and his dam in the ———. Such being the case, the said stallion is not eligible for registration in any stud book recognized by the Department of Agriculture, Washington, D. C.

(Signature) ——— ———,
Dean of the College of Agriculture.

4. The license certificate issued for a "nonstandard bred" stallion shall be in the following form:

CERTIFICATE OF NONSTANDARD-BRED STALLION NO. ——.

The pedigree of the stallion (name) ———.

Owned by ——— ———.

Described as follows: (Color) ———.

Foaled in the year ——, has been examined at the college of agriculture, and it is found that the said stallion is not elegible to registration as standard-bred, and for the purpose of this license is not purebred, although recorded in the nonstandard department of the American Trotting Register.

(Signature) ——— ———,
Dean of the College of Agriculture.

Section 1494—36. Each bill and poster issued by the owner of any stallion or jack enrolled under this act, or used by him or his agent for advertising such stallion or jack, shall contain a copy of the stallion's or jack's certificate of enrollment printed in bold face type not smaller than long primer on said bill or poster, and the first mention thereon of the name of the stallion or jack shall be preceded by the words "purebred," "grade," "crossbred," or "nonstandard-bred," in accordance with the wording of the certificate of enrollment; and it shall be illegal to print upon the poster any misleading reference to the breeding of the stallion or jack, his sire or his dam, or to use upon such bill or poster the portrait of a stallion or jack in a misleading way; and each newspaper advertisement printed to advertise any stallion or jack for public service shall show the enrollment certificate number and state whether it reads "purebred," "grade," "crossbred," or "nonstandard-bred."

Section 1494—37. A fee of two dollars shall be paid to the horse-breeding department of the college of agriculture, University of Wisconsin, for the examination and enrollment of each pedigree and for the issuance of a license

certificate, in accordance with the breeding of the stallion or jack as above provided; and a renewal license fee of one dollar shall be paid to the department of horse breeding every other year from the date of the issuance of the original license certificate.

Section 1494—38. Upon a transfer of the ownership of any stallion or jack enrolled under the provisions of this act, the certificate of enrollment may be transferred to the transferee by the department of horse breeding of the college of agriculture upon submittal of satisfactory proof of such transfer and upon payment of the fee of fifty cents; and a fee of fifty cents shall be paid for a duplicate license certificate issued where proof is given of loss or destruction of the original certificate.

Section 1494—39. Violation of any of the provisions of this act shall be punished by a fine not exceeding fifty dollars.

SECTION 2. There are added to the statutes of 1898 two new sections, to read:

Section 1494—32m. When a complaint is made to the department of horse breeding that a stallion or jack is unsound, and on investigation an examination is by the department deemed necessary, such examination shall be made by the graduate veterinarian in charge of the department, or his accredited graduate veterinary deputy; but the owner of the stallion or jack shall have the right to select some recognized graduate veterinarian to act with the veterinarian representing the department, and the said recognized graduate veterinarian, on receipt of such notice, shall so act jointly with the veterinarian representing the department, and in case these two shall fail to agree they shall appoint a third graduate veterinarian to act as referee, and his decision shall be final.

Section 1494—38m. The department of horse breeding shall keep an account of all moneys received and disbursed and shall make an annual report thereof. Said report shall be published with and as a part of the annual report of the agricultural experiment station, college of agriculture.

IOWA.

In the spring of 1907 stallion laws similar to that of Wisconsin were enacted in Iowa, Minnesota, Pennsylvania, and Utah.

The Iowa law, approved March 30, 1907, differs from those of the other States mentioned in that licenses for stallions other than purebreds are not required, although stallions standing for public service for which no license certificate has been issued must be advertised by the use of handbills and posters with the words "Grade Stallion" immediately preceding or above the name of the animal, in type not less than 1 inch in height. Another marked point of dissimilarity is that no qualifications for soundness in the stallions standing for public service are required, neither is any provision made for the recording of the license certificates by the registrar of deeds of the county in which the stallion is used.

Any person who shall fraudulently represent horses, cattle, sheep, or swine to be purebred, or who shall post or publish any false pedigree or certificate, as well as any person keeping for public service, sale, or exchange a stallion represented to be purebred without first procuring a license from the State board of agriculture, is subject to the penalty provided in this law, such penalty being a fine of not over $100 or thirty days' imprisonment in the county jail, or both.

MINNESOTA.

The Minnesota stallion law closely resembles that of Wisconsin, but, like the Utah and New Jersey laws, provides for only two classes of certificates, one for purebred and one for grade stallions. A veterinarian's certificate of soundness is required, except that in cases of emergency the stallion registration board is authorized to grant temporary license certificates upon the owner's affidavit that to the best of his knowledge and belief the animal is free from all contagious or transmissible disease or unsoundness. The issuing of temporary certificates, which are valid only until veterinary examination could reasonably be made, has been discontinued, except in extreme cases, since January 1, 1908. Section 8 provides that "stallions shall be examined every four years until ten years of age, and after first examination shall be exempt from examination at ten years of age or over."

UTAH.

The stallion law of Utah, which became effective May 13, 1907, is very similar to the Wisconsin law, but, unlike the stallion license laws in some States, provides, in addition to requiring license certificates, that every person in the State of Utah complying with the provisions of the act shall have a lien on the mare and a first lien upon the offspring of such service, to the amount of the agreed service fee. The term "grade" as used in the law applies to any stallion having a purebred sire or dam registered in a studbook recognized by the United States Department of Agriculture, and said grade shall be allowed a certificate of enrollment until January 1, 1909. No grades will be licensed after that date.

PENNSYLVANIA.

The Pennsylvania law regulating the public service of stallions came into force January 1, 1908, and varies little from the stallion law of Wisconsin, except that in addition to providing for the issue of a license certificate it provides in section 9 that "the State live-stock sanitary board is authorized to establish needful regulations, and to provide for official examination upon voluntary request from owners of stallions, and to issue certificates of approval for stallions that are approved in respect to purity of breeding, soundness, conformation, breeding, and their suitability to improve the horse stock of the State."

NEW JERSEY.

The law for licensing stallions in New Jersey, which became operative September 1, 1908, provides for the personal examination by the stallion examining and registration board of all stallions before granting them licenses. This board consists of three members—the animal

husbandman of the State experiment station, a graduate veterinarian, and a prominent breeder of live stock. The examination is accomplished by requiring all owners of stallions and jacks used for public service to present their animals at the county seat of each county, or such other place and at such time as may be fixed by the board. Three insertions in one or more newspapers in each county constitutes a legal notice of the examination. In cases of emergency, however, the board may name a committee in each county, consisting of a graduate veterinarian and a practical horseman, which shall examine all stallions and jacks presented for examination, and if passed shall furnish certificates to the owners, with affidavits stating that the animals are free from infectious, contagious, and transmissible diseases as defined in the law. The said certificates, together with the necessary papers relative to the breeding and ownership of the animals, shall then be presented to the secretary of the board, who shall issue the proper license certificate.

MONTANA.

The stallion law recently passed in Montana is very much like that of Minnesota, except that it has a few rather important additions. Provision is made for the employment by the stallion registration board of competent graduate veterinarians, to examine stallions for soundness at one or more points in each county in the State. No stallion may receive a license certificate unless examined by one of the appointed veterinarians, except in cases of emergency, when temporary licenses will be issued upon "affidavit of the owner that to the best of his knowledge and belief said horse or jack is free from infectious, contagious, or transmissible disease or unsoundness. Temporary certificates shall be valid only until veterinary examination can reasonably be made."

License certificates for stallions or jacks are not refused because of unsoundness or disease, provided such animals were in use for public service at the time of the passage of the act; however, "stallions or jacks in service previous to the passage and enactment of this law shall have described in their license certificate any hereditary disease or unsoundness referred to in section 4 of this act," and "no stallion or jack shall stand for public service in the State of Montana which is deformed or so badly diseased as to be in the opinion of the stallion registration board wholly unfit for breeding purposes, and said board are hereby authorized to refuse license certificate and registry for said animals."

Section 6 of the law provides that in all cases where a stallion or jack is imported into the State for breeding purposes, a copy of a certificate from a recognized State or Federal veterinary officer, certifying that said animal is free from the diseases or unsoundness

specified in the law, shall be mailed to the secretary of the stallion registration board at least ten days before the animal is imported. It also provides that no stallion or jack which is neither purebred nor grade according to the meaning of the law shall be imported into the State for breeding purposes. Any railroad company, transportation company, or common carrier is liable to a penalty if it transports a stallion or jack into the State of Montana unaccompanied by a State or Federal veterinary certificate.

Like the stallion law of Utah, provision is made whereby all persons in the State complying with the law shall have a lien upon the mare and the offspring for the amount of the service fee.

OREGON.

The stallion license law of Oregon is modeled very closely after the Wisconsin law, but with one important exception. No stallion owner is required to procure a license certificate for each stallion or jack which he stands for public service unless he so desires. This is readily seen in the following quotations taken from the law:

> Every person, firm, or company standing or traveling any stallion for profit or gain in this State may at his discretion cause the name, description, and pedigree of such stallion or jack to be enrolled by the department of horse breeding of the Oregon Agricultural College, and procure a certificate of such enrollment from said department. * * * The owner of each stallion or jack may make oath before a notary public that such stallion or jack is to the best of his knowledge free from hereditary, contagious, or transmissible unsoundness or disease. * * * The owner of any stallion or jack standing for service in this State may, at his discretion, post or keep affixed during the entire breeding season copies of the license certificate of such stallion or jack.

IDAHO.

The Idaho law, which became effective March 15, 1909, has some of the features of several stallion laws of other States. Any person, firm, or company offering a stallion or jack for sale must procure a license certificate in the same manner as if the animal were to be used for public service.

The veterinary examination is made by the State veterinarian or one of his assistants, and his report is sent to the live-stock sanitary board. This report shall contain a full description of the animal examined, and shall be made in triplicate, one copy being sent to the State live-stock sanitary board, one furnished to the owner, and the other retained in the book.

It is necessary that a fee of $10 be paid the veterinary surgeon before he makes the examination, but all stallions and jacks owned in the State at the time of the approval of the act shall be examined for a fee of $5, provided that they be assembled at a point designated by the State veterinary surgeon.

The list of disqualifying unsoundnesses and diseases, which differs somewhat from those in the other States, is as follows: Hemiplegia (roaring or whistling), chorea (stringhalt), bone spavin, bog spavin, ringbones, thoroughpin, enlarged side bones, urethral gleet, ophthalmia, cribbing, and curb, when accompanied by curby hock. Any marked, faulty, or weak conformation which is liable to be transmitted is also a disqualification.

Should a stallion which is granted a license certificate have unsoundnesses which do not disqualify him, they are enumerated in the certificate.

Copies of the license certificate shall be posted in a conspicuous place on the main door leading into any stable or public building where the stallion or jack is kept, whether he is for public service or for sale.

All persons complying with the law are given a lien upon the mare served and the offspring, the same as in the Utah, Montana, and North Dakota laws.

In the case of the death of any jack or stallion licensed the owner is required to forward the license certificate of said animal to the secretary of the live-stock sanitary board.

This board is empowered to make a veterinary examination of an animal at any time without charge, and if he is found to have any of the diseases or unsoundnesses designated in the act his license may be revoked.

The penalty for a violation of the provisions of the act is divided into two parts: Anyone using a stallion or jack for public service without first procuring a license is guilty of a misdemeanor and liable to a fine of not less than $25 nor more than $100, or imprisonment in the county jail for a period of not less than fifteen days nor more than thirty days for each offense. Any person selling or disposing of a stallion or jack in violation of the act is guilty of a felony and is liable to a fine not to exceed $600 or imprisonment in the county jail not to exceed one year, or both such fine and imprisonment.

It is made the duty of the county attorney of the county in which a violation occurs to conduct all proceedings against the violators of the act.

GENERAL REMARKS.

The stallion license laws of Colorado and Nebraska are practically the same as the Iowa law. The Nebraska law, however, provides for the enrollment of the stallions by the professor of animal husbandry of the University of Nebraska, and in Colorado the stallions are enrolled by the secretary of state. In Wisconsin, Minnesota, North Dakota, Montana, Idaho, and New Jersey a specific list of

infectious, contagious, or transmissible diseases or unsoundnesses is included in the law. The list in the New Jersey law is identical with that of Wisconsin, but periodic ophthalmia (moon blindness), pulmonary emphysema (heaves or broken wind), bog spavin, and navicular disease are not included in the laws of Minnesota, North Dakota, or Montana.

The stallion laws in all the States mentioned require the submission of certificates of registration in studbooks certified by the United States Department of Agriculture as evidence of the purity of breeding of stallions licensed as purebred, except that, in addition, the Minnesota and North Dakota laws provide that stallions shall be accepted as purebred which are registered in studbooks of any American studbook or registry association which recognizes and records stallions having five pure top crosses.

BENEFICIAL RESULTS OF LEGISLATION.

That the State stallion laws mark a distinct step in advance in our horse-breeding industry is hardly to be questioned. One of the first results of the operation of these laws was to provide data which show the actual facts with regard to the stallions being used for breeding purposes. The situation in Wisconsin as revealed by the data collected under the stallion law of that State is very ably discussed by Dr. A. S. Alexander in Bulletins 141, 155, 158, and 169 of the agricultural experiment station of that State, and the Minnesota stallion law is very thoroughly explained by Prof. Andrew Boss in Bulletin 1 of the Minnesota stallion registration board.

The Wisconsin stallion law has been in operation three years, and the data collected afford a very good opportunity for judging as to the beneficial effects of such legislation. Bulletin 169 of the Wisconsin Agricultural Experiment Station states that 1,561 grade stallions were licensed in 1906, and in 1908, when their certificates should have been renewed, it was found that 553, or 35.2 per cent, had been retired from public service. In addition to the retiring of these grade animals it was shown that the use of a number of unsound and unsuitable purebred sires for public service had been discontinued.

A very important indirect result of the licensing of stallions is shown in the following extract from Bulletin 141 of the Wisconsin Agricultural Experiment Station:

As the law required owners of purebred stallions to submit the certificates of registry of their horses for inspection before license certificates could be granted, it has led to more care being taken in all matters pertaining to the recording of pedigrees, the character of pedigree registry studbook societies, associations, and companies; the correctness of pedigree certificates, and the proof of identity in case of aged horses that have changed hands many times. Then, too, it has caused discussion in every blacksmith shop, livery stable, farm barn, and country assembling place relative to the importance of pedigree, the power and

prepotency of pure blood, the foolishness of breeding to horses of mixed breeding or of no known breeding; the fallacy of using horses of poor individual quality and character, and the importance of knowing exactly what is the true breeding of each stallion standing for public service throughout the State.

NUMBER AND QUALITY OF STALLIONS IN CERTAIN STATES.

Following is the total number of grade and purebred stallions enrolled up to January 1, 1909, in each State where a stallion license law has been in force long enough to furnish any considerable amount of data:

Number and percentage of purebred and grade stallions for public service in certain States, January 1, 1909.

State.	Total stallions.	Purebred.		Grade.	
	Number.	*Number.*	*Per cent.*	*Number.*	*Per cent.*
Iowa	([a])	4,825	([a])	([a])	([a])
Minnesota	3,348	1,210	36.1	2,138	63.9
Pennsylvania	[b] 2,006	[b] 666	33.2	[b] 1,340	66.8
Utah	259	189	73	70	27
Wisconsin	3,812	1,511	39.6	2,301	60.4

[a] Only purebred stallions are licensed in Iowa; they are estimated from county assessment returns to be over 50 per cent of the total.
[b] Number licensed during 1908 only.

THE DEVELOPMENT OF LIVE-STOCK SHOWS AND THEIR INFLUENCE ON CATTLE BREEDING AND FEEDING.

By E. G. Ritzman,

Assistant Animal Husbandman, Porto Rico Agricultural Experiment Station.[a]

INTRODUCTORY.

The increasing interest which is being manifested in live-stock exhibitions, especially those of national importance, indicates that their position as a factor in promoting interest in agriculture and agricultural education is becoming more firmly established each succeeding year. The national shows bring together the stockmen from all parts of the country and demonstrate to them in a practical way the improvement that may be accomplished in live-stock husbandry. From the educational standpoint these exhibitions are of great value, as they illustrate science applied and theory put into practice, and thus they have become essential as a practical supplement to the college class room.

In Great Britain the breeding shows are not combined with the fat-stock shows, and the same was formerly the case in this country. The American shows now unite these two features, because when combined they more fully illustrate the possibilities in the production and improvement of live stock. The former represent the stock-breeding interests, the latter the stock-feeding interests, including the finished fat stock both before and after slaughter. The breed classes represent the essential characteristics of good type and blood, while the fat stock illustrate what may be attained with good type and blood.

Live-stock exhibitions have developed with the growth of the live-stock industry as necessary object lessons for the stockman, and chiefly for this reason have taken root at the centers of greatest live-stock activity. The International holds the same position among stock shows that Chicago holds among live-stock markets, and the American Royal, at Kansas City, represents in the same degree the growing live-stock industry of the Southwest, while still another show of national importance, for which the prospects foreshadow a successful future, has made its appearance at Denver to represent the developing industry of the Northwest. The territory represented by the stock exhibited and competing at these three shows

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includes almost every section of the country where stock growing forms a prominent part of agriculture, and in thus bringing together in competition the best live stock of the country they become of great value in harmonizing type standards.

THE GROWTH OF THE INTERNATIONAL SHOW AT CHICAGO.

Our premier stock show, the International, held annually at Chicago, has shown an unprecedented development in the nine years of its existence. The number of entries steadily increased year by year until 1907, when the stock on exhibition originated in 23 States, 1 Territory, and 4 foreign countries, and comprised 6 breeds of cattle, 11 of sheep, 8 of swine, and 8 of horses. There was a great falling off in the number of entries at the latest show (1908), but this was due to abnormal causes rather than lack of interest. The decrease affected meat animals only, and, as may be seen from the table below, was practically wholly confined to the carload classes of fat animals. The increase in the number of horses was greater than in any previous year. The reduction in the cattle and hog entries is attributed to the high price of corn, while the decrease in sheep resulted largely from quarantine regulations because of the outbreak of foot-and-mouth disease in Michigan, New York, Pennsylvania, and Maryland.

The following tables show (1) the total number of entries at the International of each species, annually, since the commencement of the show, and (2) the entries by breeds, including the grades, at the latest show (1908):

TABLE 1.—*Number of animals exhibited at the International Live Stock Exposition, Chicago, annually, 1900–1908.*

Kind of animals.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Cattle:									
Fat	145	207	215	249	270	267	254	360	359
Breeding	730	858	898	831	759	790	814	913	889
Carloads—									
Fat	....	....	....	....	360	1,065	1,350	1,425	840
Feeding	....	....	....	....	780	380	720	660	760
Total cattle	[a]875	1,065	1,113	1,080	2,169	2,502	3,138	3,358	2,848
Sheep:									
Fat	....	....	....	248	366	316	294	416	323
Breeding	....	....	....	384	364	451	603	794	548
Carloads	....	....	....	....	400	600	950	1,450	550
Total sheep	....	....	....	[a]632	1,130	1,367	1,847	2,660	1,421
Swine:									
Fat	....	....	95	115	285	319	257	375	258
Breeding	....	....	361	348	....	....	....	....	....
Carloads	....	....	....	....	250	600	450	450	500
Total swine	....	....	[a]456	463	535	919	707	825	758
Horses	201	290	406	418	555	589	600	635	751
Total animals	....	....	....	....	4,389	5,377	6,292	7,478	5,778

[a] Exclusive of carloads.

TABLE 2.—*Number of animals exhibited in single classes at the International Live Stock Exposition, Chicago, 1908, by breeds.*

Cattle.		Sheep.		Swine.		Horses.	
Breed.	Number.	Breed.	Number.	Breed.	Number.	Breed.	Number.
Shorthorn	327	Shropshire	179	Berkshire	33	Percheron	218
Aberdeen-Angus	274	Southdown	66	Poland-China	37	Clydesdale	114
Hereford	286	Oxford	21	Chester-White	28	Shire	171
Galloway	68	Hampshire	106	Duroc-Jersey	53	Belgian	115
Red Polled	93	Dorset	78	Tamworth	3	Draft in harness	39
Polled Durham	72	Cheviot	44	Yorkshire	22	German Coach	21
Grades	128	Cotswold	86	Hampshire	28	French Coach	8
		Lincoln	52	Cheshire	0	Hackney	23
		Leicester	17	Grades	54	Ponies	42
		Rambouillet	117				
		Suffolk	13				
		Grades	92				
Total	1,248	Total	871	Total	258	Total	751

PROMINENCE GIVEN TO FAT STOCK.

When the International show was organized provision was made that the fat-stock section should be given as the main feature of the show, and notwithstanding the rapid growth in the breeding exhibits that department has maintained the position intended for it. The American Royal, which, as an outgrowth of the national Hereford breed show, has had a more gradual development, is now rapidly progressing along the same lines.

Of the two general features of live-stock shows—carloads and individual exhibits—the latter merely illustrate a more highly specialized method of feeding by which are shown the possibilities of meat production regardless of cost or application to practical conditions. However, the individual exhibit serves a useful purpose in molding the mental conception to the highest ideal, without which improvement is impossible. The carload lots, on the other hand, illustrate the practical results of the conditions that confront the feeder of fat stock.

The contest among the individual fat animals for grand champion honors of the show forms one of the chief attractions and is of special interest to stockmen. The undue significance that many attach to breed rivalry in this matter is, however, of secondary importance to the merits of quality, finish, and good blood inherent in the animal, regardless of breed. This is sufficiently indicated by the fact that of the nine International show champions four were purebred Aberdeen-Angus, two were purebred Herefords, one was a high-grade Shorthorn, another a grade Angus, and one was an animal of mixed breeding. The fact that three, or one-third, of the winners were not purebred is no discredit to pure breeding, neither is it proof of the still prevailing idea that grades are more easily kept than purebred animals. Bearing in mind that each of these animals represented the

good points of some particular breed, it becomes rather a proof of the prepotency of purebred animals in transmitting their characteristics to their offspring even when mated to animals of mixed or unknown breeding. This emphasizes the necessity of at least using purebred sires; it is better, however, to mate animals in which the breeding is known on both sides. The prices paid for carload lots at the International indicate that there exists but little preference, if any, for one breed over another.

A feature of greater significance than breed rivalry is the age rivalry of prime beef, indicating the general trend of the market and the possibilities toward earlier maturity. Of the nine champions above referred to, one was a 3-year-old, five were 2-year-olds, one was a yearling, and two were calves.

EARLY MATURITY.

Early maturity has become the keynote of the stock shows in both breeding and fat classes. The fact that in recent years two calves have won the International grand championship over fat steers of all ages emphasizes this tendency toward smaller and younger beef and the elimination of age as a barrier to the fitness of a carcass for slaughter. It is of interest also to point out that these championships were awarded by British judges, which seems to indicate that a similar change has come about in Great Britain, our best beef customer and source of fresh blood. The development of early growth and maturity is one of the most striking features of the breeding classes as well. Many breeders, especially those who breed common stock, have no doubt been astonished at recent shows upon seeing animals not over 12 months of age weighing 1,000 pounds, and sometimes even more.

A comparison of the International with its predecessor, the American Fat Stock Show, illustrates the remarkable progress that has been made within the last thirty years. Of the total number of cattle exhibited in the individual classes by age at the latter show during the twelve years from 1878 to 1889, approximately 3 per cent were 4 years old or over, 29 per cent were 3 years and under 4, 30 per cent were 2 years and under 3, 28 per cent were 1 year and under 2, and only 10 per cent were under 1 year of age. To sum up, approximately 62 per cent were over 2 years of age and 38 per cent under 2 years of age. Nowadays these conditions are more than reversed, as in the International of 1906, which may be taken as representative of recent shows, only 28 per cent were 2 years old or over, and 72 per cent were under 2 years of age.

Progress in the development of early maturity in sheep and swine has been no less marked, and conditions in these two classes of stock

at live-stock expositions probably more nearly approach actual market conditions than is the case with cattle.

THE PARAMOUNT IMPORTANCE OF QUALITY.

The remarkable improvement in the quality of the exhibits is a noticeable feature of modern live-stock shows. Regarding this feature of the improvement, Mr. B. H. Heide, general superintendent of the International Live-stock Exposition, says:

It is the opinion of everyone familiar with the character and quality of the live stock exhibited at the different expositions that there has been a decided improvement in quality from year to year. The so-called "tail-ender" has been practically eliminated from our exposition, and only the cream of the live-stock world is brought here, making it truly a show of champions and the supreme court of the live-stock industry.

The general tendency is toward an increase in the number of exhibitors and a decrease in the numerical size of their exhibits, although this is probably more characteristic of the breed classes than of the fat-stock classes. Special comment has been made on the improvement of quality in horses exhibited at the International, the most gratifying result of this improvement being the strong showing made by American-bred animals against the foreign-bred exhibits.

Quality in meat animals is a factor which is closely related to early maturity. It was not much more than a decade ago when the American Fat Stock Show provided classes for "heaviest fat steer," "heaviest fat sheep," and "heaviest fat hog." All this is now changed, and size of the carcass or animal is of secondary importance in the show ring to the quality of the meat as indicated to the touch by firmness and depth of natural flesh. This has frequently been demonstrated by the choice of young animals for the cattle championship and by placing the little Southdown above all other breeds and grades in the sheep classes. In the carcass test of cattle at a recent International, first place was awarded to an animal 156 pounds below the average weight of the whole class, and in the yearling class the winner was 158 pounds below the average weight of its class, indicating that something other than mere size or weight was first in demand. The same thing was exemplified with the sheep, since out of six prizes awarded in the carcass test three were won by Southdowns and two by Southdown grades.

Nine years ago, the year of the first International, the annual live-stock report of the Union Stock Yard and Transit Company, of Chicago, contained the following concerning the tendency in the meat trade at that period:

It has developed that consumers and meat dealers everywhere demand more meat and less tallow in the beef they buy—more flesh and less fat in meat of

all kinds. Hereafter producers of meat animals must look more to the development of muscle than heretofore. This means not only that they must feed a greater proportion of muscle-making feeds than customary in the past, but also that the animals must have at all times while growing and being fed for market sufficient exercise to develop their muscles, together with ample feed from the day of their birth, so as to grow naturally on their frames the alternate layers of muscle and fat so much desired in the dressed carcass.

Another phase of economy from the consumer's point of view was recently presented in the following statement by one of Chicago's most prominent retail dealers:

Nine out of ten buyers who come into the good markets of Chicago or any other city call for a steak that will not exceed 3 pounds, most of them not more than 2 pounds. As to the roasts, they want a four-rib roast. The latter (referring to fat yearling beeves) cuts up much better, giving off more and handier slices for serving the family than the big roast. A four-rib roast from a yearling bullock will weigh not much more than a two-rib roast from a big, thick beef, and it looks and handles much better. Same with steak. A steak of the right thickness cut from a big-weight carcass is too heavy for the use of most any family. The handy little yearling gives just the right kind of a steak for the family of ordinary size.

During the colder seasons of the year the demand is generally in favor of heavier cattle than during the warm seasons. Even cattle weighing from 1,500 pounds up occasionally bring good prices, there being a small demand for them throughout the year to supply a special hotel trade, but at the present time the supply of these more often exceeds the demand than in the well-finished smaller classes which serve an all-round purpose.

The superiority of the early-matured and medium-sized animal may be shown in a practical way by quoting the average prices brought on the open market by the carload lots of fat cattle at the International shows of 1906 to 1908, arranged according to weight. They were as follows:

TABLE 3.—*Average prices of show steers in carload classes sold at auction at Chicago, arranged according to weight, 1906 to 1908.*

Weight classification (pounds).	1906.		1907.		1908.	
	Number of carloads.	Average price.	Number of carloads.	Average price.	Number of carloads.	Average price.
960–1,000	3	$7.32	3	$5.98	1	$7.70
1,000–1,100	11	7.70	15	6.30	5	8.94
1,100–1,200	14	8.42	16	6.48	14	9.03
1,200–1,300	10	7.83	11	6.66	9	9.65
1,300–1,400	7	7.70	11	6.68	5	8.53
1,400–1,500	12	8.70	13	6.38	10	9.00
1,500–1,600	10	8.34	11	6.55	2	8.77
1,600–1,700	5	7.87	7	6.41	5	8.81
1,700–1,800	2	7.77	4	6.40	2	8.57
1,800–1,900	....	....	2	6.40	....	....
Total loads and grand average	74	8.12	93	6.48	53	9.00

The low prices obtained in 1907 are explained by the financial panic, which toward the close of that year had brought the live-stock market to its lowest ebb. It may be mentioned that the extreme range of the prices at the above sales was $6.60 to $17 in 1906, $5.65 to $8 in 1907, and $7.20 to $13 in 1908. The unusually large range in 1906 is explained by the fact that a fancy price was paid for the grand champion load that year, while in 1907 current market prices prevailed owing to the financial depression, and in 1908, although the grand champion load only brought $11, the champion yearlings were bid up to $13.

It will be seen that in general the highest prices were secured by the three medium-weight classes ranging from 1,100 to 1,400 pounds.

In 1906 the high figures continued up to 1,600 pounds, caused, however, by special prices paid for champion loads.

CARLOAD EXHIBITS.

Carload lots comprising 15 animals per carload is one of the innovations introduced at the big shows in order to comply with the practical conditions under which the stockman works. The remarkable growth of this section indicates that its practical features have effected considerable improvement over previous methods and have helped to produce a better class of market stock.

A carload of fat cattle, although judged as a unit, is composed of a collection of units. While it may be a comparatively easy matter to feed a single animal so as to develop in it the highest qualities demanded by the market, it is an entirely different proposition to develop that same standard of excellence uniformly in a number of animals. There are four main features which always characterize a high-class carload exhibit of fat stock, namely, (1) finish, (2) type, (3) breeding, (4) uniformity. Each of these will be briefly discussed:

FINISH.

From the market point of view, finish is the most necessary qualification to win honors in the show ring, because it is the most essential from the butcher's point of view; thus animals possessing it bring the highest price on the open competitive market. It is necessary to use the hands as well as the eye in order to determine fully the comparative merits of the various exhibits regarding this quality. An animal may have been fed beyond the point of full bloom that constitutes an ideal finished condition, in which case it has become soft; or it may not have been developed up to that point, in which case it would be too firm, a condition which is equally undesirable. The tendency of the average run of stock on the market, especially cattle and sheep, is generally in the latter direction.

TYPE.

Type refers principally to the relative form and proportion of parts, or, in other words, to the conformation of the animal; however, broadly speaking, it includes quality, which is recognized as one of the necessary attributes of the highest type of meat-producing animal. Curtiss, speaking of type as an individual rather than a breed characteristic, describes it as follows:

> These animals, though representing different breeds, present that compactness of form, thickness, and substance, together with superior finish and quality, coupled with an inherent aptitude to lay on flesh thickly and evenly, that always characterizes the beef animal of outstanding merit.

One of the objects of live-stock expositions is to harmonize the ideas of producers, especially in the development of type, and thereby to encourage improvement solely with a view to profit. There is always a general tendency for breeders to diverge from a uniform standard. Many of them follow the dictates of their own desires in an endeavor to establish types to suit their own fancy. Too often in the past it has been true that the perpetuation of breed or family characteristics of minor importance have been deemed of more value than type. Breeders of unimproved stock have kept on breeding with almost entire disregard to an accepted standard of type, or at least without any lucid idea concerning the essential characteristics that compose it. The markets recognize but one type of animal as the most profitable for meat production, and prices are determined according to the degree with which they approach this type, other conditions being equal. There exists, therefore, a direct relation between the type of the various meat-producing animals and their value. While perfection in type may perhaps never be attained, a more or less near approach to it will be seen in all prize-winning exhibits. It is interesting to note also how on the one hand animals of different breeds will resemble each other in this respect, and on the other hand what a wide difference in type may exist between animals within the same breed.

A study of type in the carload lots is perhaps more instructive and useful than any other feature of stock shows, owing to the practical nature of this part of the exhibits. Cattle, for example, are fed under practical conditions and judged on their utility for slaughter, the merits of this judging being further verified by their sale at auction. The addition of a class at the International in which the same cattle are shown as feeders one year and as fat cattle the next year affords a practical demonstration of real merit in which the value of type plays a prominent part.

BREEDING.

Breeding in an animal is much the same as in human beings, namely, it implies an ancestry from which some characteristics have

been inherited which are superior to those found in ordinary individuals. Good breeding, or improved breeding, is the result of years of careful, systematic work in the selection of breeding stock with a definite purpose of intensifying and perpetuating certain superior qualities and characteristics. When these characteristics have become firmly established the result generally is a new breed. An animal need not be purebred, however, in order to show good breeding. Owing to the prepotency of purebred sires, grades are often produced which possess all the superior points of excellence of purebred animals. A notable example of this was Roan King, the grand champion of the 1907 International. This steer was by a well-known Shorthorn sire out of a common cow of no particular breeding, yet Roan King inherited from his sire all the best characteristics of the Shorthorn blood.

An equally strong example of good breeding is found in the range exhibits, where the continued use of purebred sires has brought about a remarkable transformation. The former long-horned range steer has been changed to an animal that now rivals the purebred stock of the eastern farm for championship honors in the show ring as well as for market-topping records. One can not view the carload lots of cattle at the great stock centers without being impressed by the evidence of good breeding, and there remains hardly any reason for doubt that the continued successes at shows of improved breeds of stock over the common kinds has been a strong incentive to general improvement in breeding.

UNIFORMITY.

Uniformity is a characteristic that marks every first-class carload exhibit. It is a characteristic which applies equally to breed, type, and finish, and it has a direct bearing on market prices. At long-range observation it is most apparent in color, which, together with markings, constitutes a reasonable amount of evidence of the breeding of the animals. It is in type, however, that uniformity sets off a good load of stock, this being the index to the animals' value as meat producers.

SHORT-FED CATTLE.

Every now and then new conditions arise with which the average stockman is more or less unfamiliar, and wherever possible it has been the aim of the premier shows to encourage exhibition and competition along these lines in order to throw light on the best way of overcoming new obstacles.

With the passing of the range and the development of the country toward general farming conditions there has gradually come about a narrowing of prices between feeder cattle and fat cattle. As a re-

sult, feeders often find that the high prices of feed—especially corn—makes feeding periods lasting one hundred and eighty days and longer unprofitable. Furthermore, the profits made in a good feeding season are often entirely offset by losses in a poor feeding season.

Experiment stations have begun to study methods of overcoming this by testing the feasibility of shortening the feeding period without sending the stock to market in a half-fat condition. The first exhibit in short-fed cattle was seen at the International in 1907 and created no small amount of interest. It was marked by a small beginning, consisting of only three entries, but the results attained by the first-prize entry were so striking that very likely more attention will be given to it in the future, as the conditions under which short feeding periods can be resorted to have been plainly demonstrated.

The prize exhibit referred to were high-grade Herefords of exceptional good quality and breeding, and when started on the feeding period for the show they were in good grass-fed condition. The period of feeding was ninety days, which is only about one-half the time that feeders generally find necessary to fatten cattle for market, yet they brought $6.45 per hundred pounds, or only $1.55 less than was realized by the grand champion carload, and only 3 cents below the average of all the carloads of fat cattle sold, none of which, it is safe to say, had been on feed under one hundred and eighty days, and some probably up to one year. It may reasonably be inferred from this that cattle can be put into good marketable condition and at a materially reduced expense of feed in a comparatively short period of time if they are well bred, of good quality, and in pretty good condition at the start.

CARCASS COMPETITIONS.

The carcass competition is a natural supplement to a fat-stock exhibition, since it alone gives the true value of an animal so far as the meat dealer is concerned. In judging a fat animal on foot the main object therefore is to arrive as nearly as possible at the results that would be obtained in a carcass test. Owing to the present methods of dealing in our live-stock markets the judging of live stock on foot is an absolute commercial essential to dealers, and producers of fat stock also rely entirely on external inferences to determine fitness for slaughter. Awards in dressed-meat classes often vary, however, from the relative placing of the same animal alive. The judging of live animals is necessarily influenced to a certain extent by general characteristics, such as breeding, symmetry, constitution, etc., which considerations are entirely lost in the dressed carcass, while on the other hand a dressed carcass may prove an exception to reasonable expectations as regards color of the meat, amount of internal waste fat, or

relative weight of cuts; thus there often results a variance of opinion on the merits of an animal when judged before and after slaughter. It is only from continued study in the comparison of the results of these two methods of judging that one can become perfectly familiar with the true value of external indications.

It would appear, however, that the average show beast is still somewhat too fat to be the most profitable for the general trade, and that the judging of animals on foot has yet to be sufficiently harmonized with the judging of the carcass. These two points were amply demonstrated in the slaughter test at the 1908 International. With the laudable view of increasing the educational value of the carcass competitions the animals entered in the two slaughter classes at this show were first judged on foot (from the killing standpoint) by one of the best known judges of butcher cattle, and after slaughter another expert placed the carcasses in order of merit from the point of view of the practical butcher. There were five prizes in each of the two classes.

Of the 2-year-olds, the first, second, and third prize winners, alive, were not in the money at all after slaughter, the remaining two being placed second and fifth, respectively, by the carcass judge. It was a similar story with the yearlings, the first, third, and fourth alive not receiving any mention after slaughter. Thus, of the ten prize winners on foot only four were recognized when placed on the block.

It is true that the carcass judge leaned strongly to the type of steer that would cut up best for the general trade rather than for the limited special trade, and therefore favored carcasses yielding the maximum amount of edible meat with just sufficient marbling to make them tender and without excessive outside fat. It was stated, however, that the judge of the live classes also criticised and rejected some likely candidates because of their being too fat.

In any event, after making allowance for the individuality of the judges, it appears evident that there is at present too great a discrepancy between expert opinion regarding the merits of a body of beef before and after slaughter.

It is unfortunate that less interest appears to be taken in the carcass demonstrations at the great shows than in other competitions. It would be of great value to all stockmen to make a close study of the carcass tests at every opportunity, after first, however, forming an opinion of the animals alive; they may thus verify their judgment in a practical way.

At present the carcass test is a very limited proceeding, being carried out on a small number of animals from individual exhibits, and it is to be regretted that more details regarding this and other practical features of the shows are not published in the trade papers. In this respect British stockmen are more fortunate, since one of the

commendable features of the Smithfield fat-stock show is the publication of details of almost every animal exhibited regarding its age, weight, gains made, and slaughter value (dressed weight). A similar publicity of details on the averages of carload lots, if possible, with some information as to character and amount of feed consumed and effect of feed on the meat, and a statement regarding the management of the exhibit during the course of preparation, would undoubtedly be of great value and interest to readers.

Our stock raisers who visit the shows have little difficulty in properly appreciating the merits of the high-class exhibits, yet for lack of detailed information as to how such results are accomplished they are apt to carry away the false impression that such exhibits can be produced only at a cost that would mean a loss from the commercial standpoint, and so the object lesson has little value for them. However, with the present progressive development of live-stock shows it can reasonably be expected that such additional information will eventually be available to the public.

THE VALUE OF THE POULTRY SHOW.[a]

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Broadly speaking, we may consider the value of the poultry show to those participating and to others as falling under three heads: (1) Educational, (2) commercial, (3) social. But before discussing these various values it may be of interest to give some consideration first to the different classes or groups of people that generally frequent poultry shows.

THE PATRONS OF POULTRY SHOWS.

In attending a good-sized representative show for the first time one is struck almost as forcibly by the number and variety of types of human beings present as by the number and variety of poultry. Here we find persons of all classes and all stations in life, side by side, on a footing of equality and with a fraternal feeling aroused by the common admiration for poultry. Compared with other branches of live stock the poultry industry is fortunate because of the fact that more persons are interested in it than in any of the others.

We find the crowd enjoying the show to be mostly composed of the following three classes—fanciers, transient visitors, and plain or utility poultrymen. The fanciers comprise the exhibitors at the show, while there are many others actively engaged in the fancy business who either as a matter of business or for pleasure are attending the show although not exhibiting. This class is one of the largest and undoubtedly the most interested group. The transient visitors make up, perhaps, the most numerous of the three groups. This class is usually quite composite in character, including mostly city dwellers, many of whom have kept or are keeping a few hens and who are consequently interested, and others who are interested in but a casual way and who attend the show largely out of curiosity. The third class—the poultrymen—the writer believes to be by far the smallest, a condition which is, to say the least, deplorable. This group includes a few farmers who keep a few hens and who have happened to be in the city at the time of the show; also a few exclusive poultrymen who keep

[a] This article is based on a paper read during the Washington Poultry Show, January 29, 1909.

hens for eggs or meat alone and pay no attention to fancy points or, in many cases, even to whether their stock is purebred. These men must attend largely out of curiosity, for aside from the industrial exhibits there can be little benefit from their standpoint to be derived from a modern poultry show. This, as will be pointed out later, is not exactly the fault of the show, but rather of the state of the industry. It is possible, however, that something can be done to bind together more closely the interests of the purely utility poultryman and the poultry fancier, a condition which could hardly fail to be an improvement and an advantage and a consummation greatly to be desired.

There is still another fairly large group of show patrons which is composed of dealers and manufacturers of poultry appliances and of poultry journalists. The members of this group attend, presumably, both for business reasons and for pleasure.

EDUCATIONAL VALUE OF POULTRY SHOWS.

The educational value of the poultry show to the fancier, and particularly to the beginner, can not be overestimated. A study of the standard or other descriptions without the opportunity to see live specimens could never give the clear, concise conception of a variety which the poultry show with its numerous well-bred birds creates. Nor is this benefit lost to the experienced fancier, for every opportunity which he gets to see the birds of his competitors and to meet and exchange ideas with his fellow-breeders is of direct educational value. After all, poultry breeding, like all other live-stock breeding, follows certain fashions, which are constantly changing more or less slowly, and for this reason the fancier who never visits the poultry show and never has opportunity to observe other men's stock can scarcely expect to keep abreast of these fashions in birds. To the fanciers, therefore, both old and new, the poultry show is a liberal education, and in some sense a necessity.

To those not particularly familiar with poultry and who attend the show largely from curiosity the exhibition has also a distinct educational value. It opens their eyes to the extent and degree to which poultry breeding has been carried, and brings a realization of the importance of the industry. In this relation the show has a direct value to the industry in arousing interest in poultry breeding and in gaining many new recruits.

To the plain or utility poultry man the show has, of course, an educational value. It may open his eyes to the value of purebred stock as compared with scrub or mongrel stock, though here it would seem to fail somewhat in its possibilities. The writer has been informed, however, that this educational influence is felt in the increasing difficulty which is met by fanciers in selling cull stock. The industrial exhibits are also valuable to the poultry man, quite as much so, in fact,

as to the fancier. To this class the show should have a much more far-reaching effect than at present exists, and it is in this respect that reforms should be initiated.

POULTRY INSTITUTES.

Any discussion of the educational value would be incomplete without mentioning the recent very general adoption of the plan of holding institutes in conjunction with poultry shows. These so far have seemed to prove quite satisfactory, and the demand for them seems to be increasing.

The American Poultry Association has put itself on record as encouraging the holding of these institutes, and has thus done a valuable piece of work.

The publicity given to the poultry show has also a salutary effect on the industry by keeping it in the public view and bringing to the realization of the people as a whole the vastness of the industry and its widespread interest among all classes. While hard to show as a concrete benefit, this value is nevertheless very definite and very real, and the industry as a whole owes much to the show as a result.

COMMERCIAL VALUE.

The commercial value of poultry shows is principally manifest in the case of the fanciers and dealers in poultry supplies and the publishers of poultry literature. Here the fancier may show the most finished result of his labors, and because of many appreciative observers obtain adequate prices for such as he has for sale. The show serves as a market where the producer of the best brings his wares, and where those looking for the best and ready to pay for it come with the intention of buying. Without such shows, sales for large sums, such as we now commonly hear of, would be of infrequent occurrence, and would probably never have reached the present prices. Much of the fanciers' most lucrative trade may be traced to these shows. A prominent breeder recently stated that he could trace $12,000 worth of business during the past year directly to a single large show. The poultry show certainly does not fail in this respect.

The dealer in supplies and the publishers have the opportunity to exhibit their wares in a complete state to a very large number of interested persons, and in this way bring about the introduction of many excellent devices and the circulation of much valuable information more quickly than would otherwise be possible. Needless to say this is a great benefit to dealers and to the poultry public as well.

To the plain or utility poultry man, however, the commercial value is below what it should be. Certainly some sales of this character are made and some business is thus obtained, but this is far below

what would seem possible, and improvement in this respect can only be brought about by emphasizing the utility attraction of the show.

SOCIAL VALUE.

This phase of the poultry show has been mentioned. There is, of course, no concrete way of measuring this value, but it is well recognized that much pleasure and benefit of a social character is always obtained where a body of men with similar interests meet and have an opportunity to get in touch with one another. It is hardly necessary to enlarge upon this subject; anyone who has ever attended a poultry show must have felt this influence strongly.

SHORTCOMINGS.

FAILURE TO EMPHASIZE SUFFICIENTLY THE UTILITY SIDE.

So far we have dealt largely with the advantages of the poultry show, which are undoubtedly great and scarcely possible of overestimation. At the same time it has certain shortcomings and in certain respects fails to perform much good of which it would appear capable. The greatest of these shortcomings, and perhaps the only one of importance, is the failure to emphasize sufficiently the utility side of the industry and to provide the same advantages both educational and commercial for the plain poultryman that it does for the fancier.

It is not the intention here to belittle or decry in the slightest the present breeding of fancy poultry. This activity is a most laudable occupation and represents a very highly developed art. Neither is it meant to criticise the American Standard of Perfection. So far as the writer is aware, the present standard fulfills most admirably the object for which it was created, and is a work which shows the result of a great deal of thought and labor. In constructing it, however, there does not seem to have been a conscious and well-directed effort to increase the utility value of the poultry. It has undoubtedly accomplished this to some extent, but not to the full possibility, and this failure has no doubt been due to the lack of a general understanding of the definite principles back of these utility qualities. In other words, the purely fancy points have been pushed forward faster than the utility qualities, with the result that from the utility standpoint the former receive too great a degree of emphasis.

INFLUENCE OF CONFORMATION ON UTILITY QUALITIES.

As compared with other live-stock industries the poultry industry is seriously handicapped through lack of certain specific knowledge. Take, for instance, the dairy industry. A certain definite correlation is acknowledged to exist between the conformation and other physical characteristics of the cow and her power to produce milk.

This is universally recognized, and in judging dairy cattle these qualities receive most careful attention. The producing qualities of a cow, as shown by physical characteristics, are therefore given primary attention, and the utility qualities emphasized beyond the purely fancy points. The result is obvious. It encourages and makes possible the breeding of better cows without the loss of breed characteristics.

Unfortunately, little is known absolutely about the correlation existing between the physical conformation of a hen and her laying capacity. That some such relation must exist seems almost certain. Just as certain as a particular conformation in a cow in the majority of cases indicates physical ability to produce milk, so should certain physical qualities in a hen indicate ability to produce eggs. Unfortunately, owing to our lack of knowledge, little can be done along this line at present, but as soon as reliable information is available these qualities should obtain recognition in the poultry show. The subject is a most promising field for investigation, and work along this line is very much needed.

We have some definite information as regards the conformation of a fowl and its ability to produce meat economically, though our knowledge is by no means complete, and here lies the greatest promise of a broader field for the poultry show. It is easy for anyone to see that it is perfectly possible to determine what is the most desirable type of fowl for table use. From this it is a comparatively easy step to determine what characters a fowl should possess in order to be a profitable breeder. For this purpose a bird is desired which will prove to be a good feeder and an economical producer. We know that certain characters are usually associated with such tendencies, namely, those denoting strong constitution, such as a broad head, a short, stout, curved beak; a bright, clear, alert eye, an erect, sturdy carriage, and others showing a conformation indicating the development of the parts carrying the more valuable portions of edible meat.

A recognition of these characters and of this type is highly important. If this recognition were well developed it would lead to selection for these characteristics, and would do more to improve the poultry of this country from the standpoint of table fowls than could be brought about in any other manner. Consider, for example, the present high development of beef cattle. This development has been reached only by a well-defined recognition of the type desired and after long-continued selection with this type in mind.

CLASSES FOR TABLE POULTRY.

The poultry show affords unexcelled opportunities for educating the poultrymen of the country to an understanding of the principles

which should lead to the rapid and lasting improvement of poultry stock from a table standpoint. This could be brought about by the establishment of breeding classes of fowls possessing the qualities making them suitable for table poultry. This, as intimated before, would require a special standard by which they should be judged, which would be more lenient in regard to certain more or less superficial characters, such as shape and size of comb and the fine distinction and variation of color, but which should, nevertheless, set a premium on the evidence of pure breeding and which should modify the present shape requirements so as to emphasize most strongly the type desired for the specific purpose of producing table poultry. A premium should be placed upon evidence of pure breeding, not because a particular purebred fowl may be better than a particular crossbred fowl for table purposes (for in many cases this would be untrue), but because a purebred fowl would be much more valuable for breeding purposes, as it would more surely tend to reproduce its type.

It has been argued that it is impracticable to introduce such classes in a poultry show. If such is the case, the writer has yet to be convinced of it. There are more or less real objections to having dead or dressed classes of table poultry, although these classes are successfully carried out in both England and Canada. One of these objections is the difficulty of keeping dressed poultry through the show and still having it in a condition suitable for sale. Another is that in order to exhibit one's best fowls in these classes it is often necessary to sacrifice the most valuable breeders. There also seem to be objections in the way of showing live fowls in fat classes, due principally to the fact that the birds are subject to shrinkage owing to the excitement and discomfort entailed by shipping to and exhibiting at a show, it being practically impossible, therefore, to fit a fowl and keep it in prime market condition until judged.

BREEDING CLASSES.

The above objections appear to be of sufficient weight to preclude the possibility of having dressed or fat classes, but do not apply to the feasibility of having breeding classes. The idea in judging such a class would not be to award the premium necessarily to the fowl in the best condition, but to the one showing by its conformation and evidence of vigor that it was most likely to produce uniform offspring of good market type. Such breeding classes could be offered for both medium and heavy breeds of either sex and for both young and older birds. The classes could be confined to individual breeds if desired.

The exhibition and judging of a class of fowls with this purpose in mind would do far more to improve the poultry stock of the country

and to educate the farmer and others interested in poultry as to the most desirable type of breeding fowls for table use than anything that has previously been done or seems likely to be done. Nor can the benefit to be derived by the poultry show from such an addition be doubted should interest once be aroused in this direction, as it would mean a greatly increased patronage from a class not now particularly attracted by the exhibition. There are many farmers who would be decidedly eager to learn how to breed poultry that would means better carcasses produced in a shorter period and in a more economical manner, but who now listlessly and inactively consider the possibility of raising fancy stock which they might be able to sell for $5 each. The first possibility makes a more direct appeal because it deals with conditions for which the farmer is striving and which he has reached to a certain extent with his cattle and his hogs. Let us remember that the great bulk of poultry is raised by the farmers and that its enormous money return goes principally to these men.

IMPROVED METHODS FOR THE PRODUCTION OF MARKET MILK BY ORDINARY DAIRIES.

By C. B. LANE, *Senior Dairyman*, and KARL E. PARKS, *Architect, Dairy Division.*

The object of this article is to present in a simple way the various steps in the production, handling, and distribution of market milk, particularly from the standpoint of the small producer. No attempt will be made to describe the finer points applicable to a special product such as certified milk, but the object is rather to point out practical methods adapted to the ordinary dairyman. In view of the fact that the rules and regulations pertaining to the production of milk, as formulated by boards of health, both city and State, are requiring higher standards on the part of the dairymen, it is quite important that they should know how to meet them. Many dairymen would be glad to improve if they only knew how to go about it, but frequently they have nothing to guide them.

A list of publications dealing more at length with various matters which are discussed only briefly here will be found at the end of this article.

THE COWS.

The health of the cows is essential for the production of good milk. They should be in good physical condition and free from disease. They should also be tested for tuberculosis by a capable veterinarian at least once a year, and all reacting animals removed. The object of the tuberculin test is not only to safeguard the milk supply but to protect the herd from the ravages of this disease. The feed of the herd should be wholesome, and the water supply should be protected from contamination.

Dirt and dust adhering to the cows are responsible for most of the contamination of milk. It is therefore essential that the cows be clean—not necessarily washed every day and dried with a sterile towel, but clean in a common-sense meaning—that is, free from accumulation of dirt and manure, and thoroughly brushed. If the hair on the udders, flanks, and tails is clipped, this will aid in keeping the animals clean.

THE STABLE.

The stable should be free from contaminating surroundings and well drained. It should be constructed with a view to the comfort

of the cows and to keeping it clean with as little work as possible. Ledges, etc., which collect dust should be avoided. (See fig. 56.) Details of construction will not be discussed here, as that subject is covered in another publication. (Circular 131 of the Bureau of Animal Industry.) It may be said, however, that the floors and gutters should be tight and preferably constructed of concrete. The walls and ceilings should also be tight. Some form of swing stanchion will give the cows plenty of freedom and keep them lined up on the gutter. The mangers should be low. When practicable the stalls should be constructed of metal piping (see fig. 62) exposing the

FIG. 54.—Cows in filthy condition. It is impossible to produce clean milk under such conditions.

least possible surface for collecting dust and allowing free circulation of air. An abundance of light is very important; 4 square feet of glass to each cow will be found about right. About 500 cubic feet of air space should be provided for each animal.

A system of ventilation should be provided that will keep the air fresh and pure at all times. The King system [a] has been found very satisfactory. Its essential features are several inlet flues to admit and distribute fresh air and one or more outlet flues of adequate size

[a] The King system of ventilation is described in Bulletin 164 of the Wisconsin Agricultural Experiment Station.

to assure rapid removal of foul air. Where it is not practicable to install the King system, the muslin-curtain system will be of some benefit. This consists of pieces of muslin nailed over openings in the walls at suitable places. The grade of muslin known as "Four and one-half" is about the right quality. Adjustable windows are better than no ventilation.

The most common defect in dairy stables is lack of cleanliness. Cobwebs and manure on walls and ceiling are met with in every section of the country. The dairyman should see to it that this criticism can not be made of his stable. A coat of whitewash twice a year will

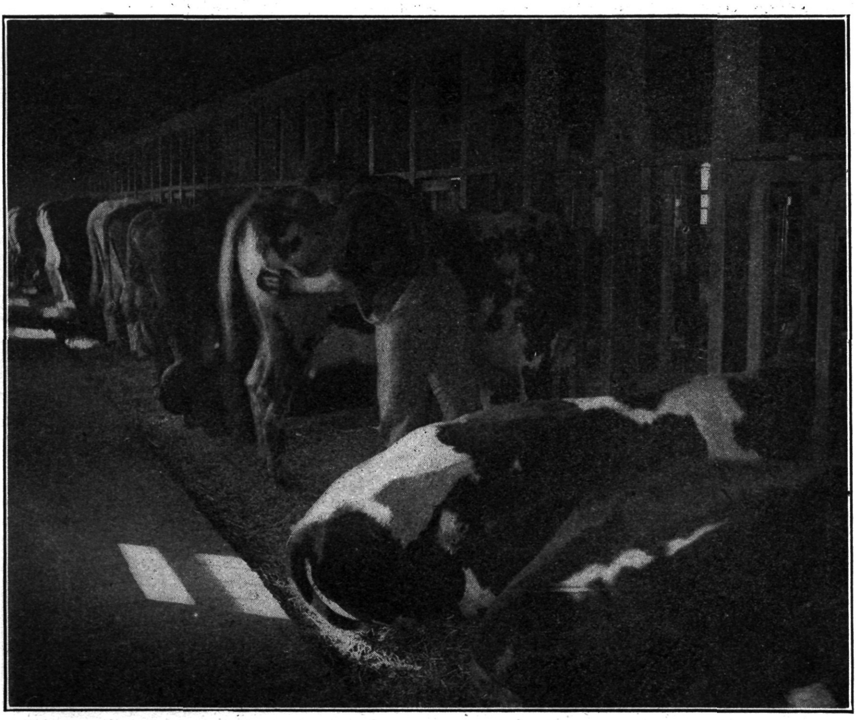

FIG. 55.—Clean cows in a clean, comfortable stable. The cows are supplied with plenty of bedding.

make the stable lighter and the air sweeter and will destroy countless germs. No other animals than the cows should be allowed in the stable. The barnyard should be well drained and free from manure and rubbish. The manure should be removed at least twice daily to the field or a safe distance from the barn, say, 40 or 50 feet. Manure about the stable breeds flies and gives off bad odors.

THE MILK HOUSE.

The milk house should be located at a convenient place where there is good drainage, and should be free from contaminating surround-

ings. A cement floor is very important, and this should be extended up on the sides at least 6 inches, or, better still, to the window casings, particularly in the wash room. Light and ventilation should be provided, and the windows and doors should be screened in summer. Cleanliness is of great importance here, and the whole interior, including floor, walls, ceiling, and windows, should be kept clean.

PLAN FOR A MILK HOUSE.[a]

The building illustrated in figures 58 and 59 is designed to provide an inexpensive and conveniently arranged milk house for the

FIG. 56.—An undesirable stable. Note cobwebs heavily laden with dust, and wooden construction, which collects dirt and requires much labor to keep clean.

dairyman who produces milk for shipping or retailing from a herd of 25 to 60 cows. The building is divided into four rooms, arranged to eliminate unnecessary labor and at the same time to provide sufficient space for the apparatus, its operation and care. The best location for the milk house would be about halfway down the length of

[a] Persons desiring to build a milk house according to this plan may obtain a blueprint showing details of construction on application to the Dairy Division, Bureau of Animal Industry, Department of Agriculture, Washington, D. C. Refer to plan H–2.

the barn and 12 to 15 feet distant from it. A door in the side of the barn at this point, opening from a cross alley, makes it convenient for the milkers and saves unnecessary time and travel. A driveway should be placed between barn and milk house for bringing empty cans, bottles, fuel, ice, etc., to the milk house, and for loading milk upon the delivery wagon.

In one corner of the building a small weigh room is partitioned off, the floor of which is raised 24 inches above the main floor; this room is entered from the vestibule. The milker takes the milk of each cow to this room, where it is weighed, recorded on the milk sheet,

FIG. 57.—An insanitary milk room. The family washing is being done in the same tubs in which the milk cans and utensils are washed. Part of the clothes are hanging on the milk-can rack to dry, and piles of soiled clothes, boots, shoes, etc., are scattered around the floor. These conditions favor the spread of contagious diseases through milk.

and emptied through the funnel (A), which is provided with cheesecloth strainers and a hinged cover. The milk passes from the funnel by gravity to a mixing tank and cooler (B), from which it empties into a can which is carried over to the bottle filler (C) for immediate bottling, or into shipping cans which may be placed in the pool built into the bottom of a refrigerator (E). If it is desired to separate the cream, a steam turbine separator would be provided at N, run by steam from the boiler. It will be observed that the milk room is so located that it is not necessary to enter it except to care for the milk, thus making it easy to keep clean and cool and free from flies, dust, and other contamination.

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The bottled and canned milk is placed in the refrigerator (D) until time for shipment, when it is loaded from the vestibule to the wagon. The refrigerator is built into the building, with ice storage overhead, which is filled through a door from the outside, directly from the wagon. The pool in the floor is supplied with spring water by a ram or other means, and is provided with an overflow to maintain a certain height of water. The melting ice drips into the pool, which also tends to keep the temperature of the water low.

A door from the rear gives access to the boiler room and the wash room, and through this door empty bottles and cans are returned from the wagon for cleansing. The wash room is provided with a

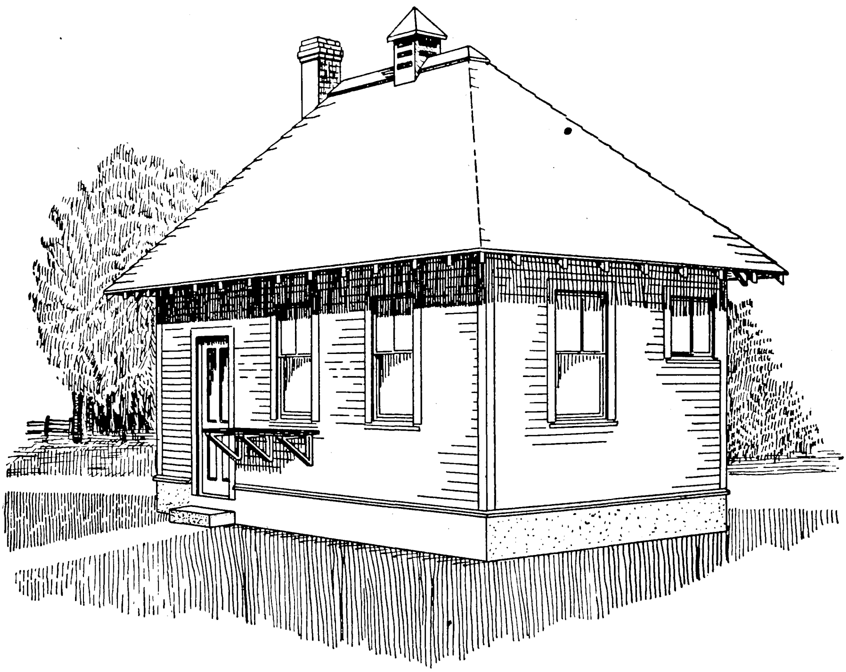

FIG. 58.—A practical and inexpensive milk house for a dairy of 25 to 60 cows.

two-compartment concrete sink, the larger compartment (I) for washing cans and bottles with soapy water, and the smaller (H) having a revolving brush for brushing and rinsing the bottles in clear water. After the bottles are washed they are placed in galvanized iron bottle carriers in an inverted position and the carriers are placed in the sterilizer (F) on runs provided for them. The sterilizer as shown (fig. 60) will hold 240 1-quart bottles. Below the bottles in the sterilizer is a space for sterilizing cans, pails, and other apparatus, so that all may be sterilized at one time and left in the sterilizer until they are to be used, which keeps them sterile and free from contamination. Sterilization is accomplished by turning in

steam for not less than thirty minutes (low pressure). A door from the sterilizer to the milk room is provided so that the bottles may be conveniently taken from the sterilizer and placed on the bottle-filler table for filling.

The wash room also has an outside door, giving access to a sunning rack for sunning pails, cans, etc. There should be no driveway in front of the building, as this causes a great deal of dust and dirt, which blows over the sunning rack and in at the windows and doors. In the wash room is also provided a table and a Babcock tester (G) for testing samples of milk. The boiler room contains a small farm boiler which provides steam for sterilizer, separator, and bottle filler and hot water for sinks.

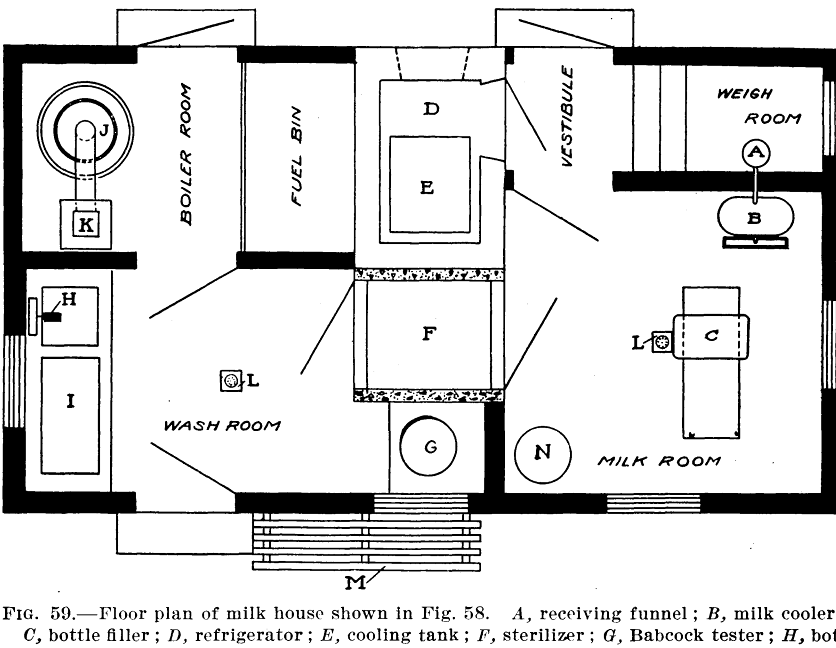

FIG. 59.—Floor plan of milk house shown in Fig. 58. *A*, receiving funnel; *B*, milk cooler; *C*, bottle filler; *D*, refrigerator; *E*, cooling tank; *F*, sterilizer; *G*, Babcock tester; *H*, bottle washer; *I*, concrete sink; *J*, boiler; *K*, chimney; *L*, floor drains; *M*, sunning rack; *N*, separator.

If it is desired to cool the refrigerator with a brine tank a small engine and ice machine could be placed in the space allowed on the plan for a fuel bin, with condenser placed on the refrigerator wall, and fuel bin built just outside boiler-room door.

The building itself is 12 by 22 feet outside the frame, and height of story is 11 feet 2 inches in the clear. It is a light frame structure placed on a concrete foundation built 18 inches above ground, and has a concrete floor 6 inches below top of foundation wall. This brings the sills above the floor, so they will not rot from the dampness, as the floors should be washed daily.

The exterior of the building is covered with weatherboarding, boards and battens, or roofing paper, as desired, while the interior is plastered in weigh room, milk room, and wash room with cement plaster on metal lathing and finished in white enamel paint. The walls are plastered against door and window frames, and casings omitted. All corners are plastered round and smooth to avoid lodging places for dirt and germs. Ventilator flues from the ceiling of milk and wash rooms are connected with the monitor on the roof. The boiler room is left unfinished except on wash-room partition, which is sheathed to protect plaster on wash-room side.

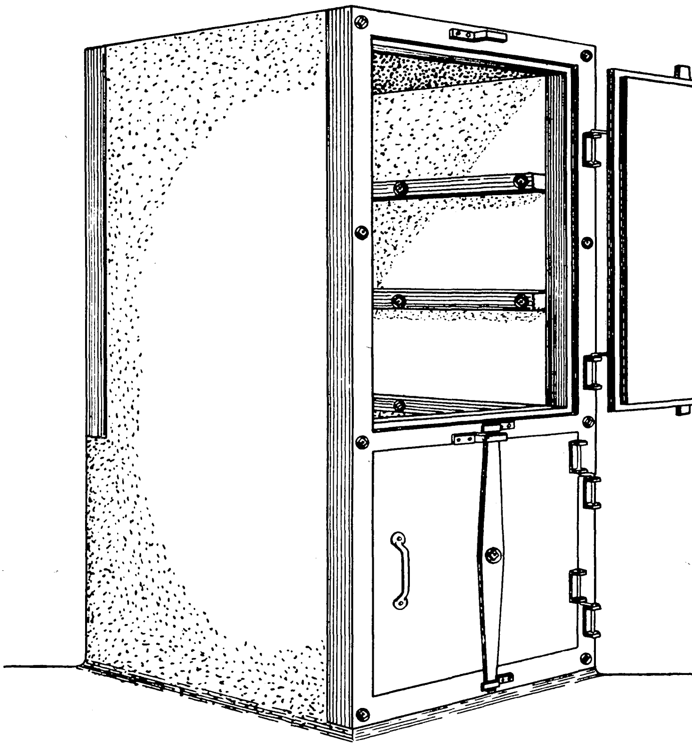

FIG. 60.—Sterilizer for milk bottles, cans, etc.

The building should be built for from $200 to $400, according to location, cost of material, labor, etc.

UTENSILS AND EQUIPMENT.

The utensils are a very important part of the dairyman's equipment. The cans and pails should be well built, with seams well flushed with solder, or, better still, no seams at all. All utensils require the most careful attention in regard to cleaning and sterilizing. They should be thoroughly washed and subjected to live steam or boiling water, then inverted in pure air. The kitchen stove rarely

answers the purpose for heating water for the reason that the amount so heated is usually limited, and by the time it is taken to the place where the washing is done it has become too cool to have any effect as a sterlizing agent. A large hot-water tank or a boiler is necessary for the purpose. It is important that the water used in cleaning be pure, as contagious diseases have frequently originated from water used in washing.

Some form of small-top or covered milk pail is very important in milking (see figs. 61 and 64). Figure 61 illustrates the advantage of the covered pail over the ordinary open pail in keeping dirt out of the milk. W. A. Stocking, jr., made tests with open and covered pails in a stable where but little care was given to cleanliness, and found that milk drawn in the open pail contained an average of

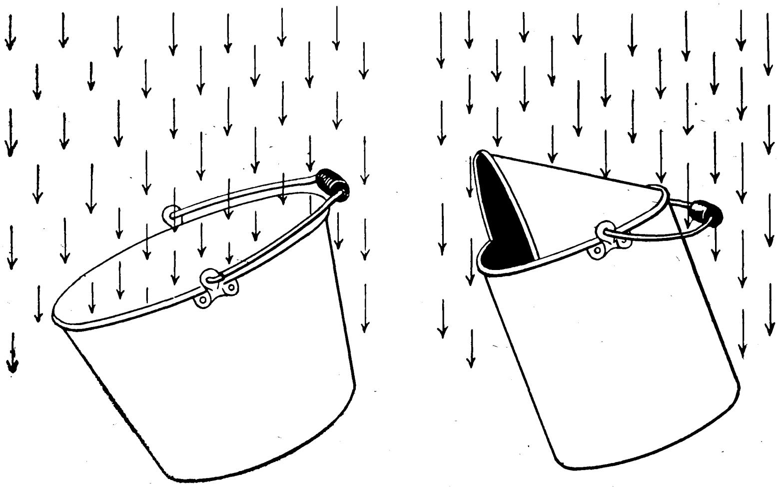

FIG. 61.—Two kinds of milk pails. The open pail admits much dirt; the covered pail keeps it out.

3,439,200 bacteria per cubic centimeter, while that drawn in the covered pail contained an average of only 103,600.

A metal stool for milking is more desirable than a wooden one. It is less cumbersome and far more sanitary.

A milk cooler is another important part of the dairyman's equipment, unless the milk is drawn directly into the shipping can (as in fig. 64). The cooler must be kept clean and not located near the stable.

A cheap but practical sterilizer for a small dairyman is shown in figure 60. It is constructed of concrete, reenforced with metal lathing, and fitted with wooden doors lined with galvanized iron. The open door shows the runs on which the carriers are placed. Each space accommodates 5 carriers holding 16 one-quart bottles each. This sterilizer will cost from $30 to $50, depending upon the price of material and labor.

MILKING.

The milker should prepare himself for milking to the extent of putting on a special suit or outer garment. A big apron used by some dairymen is better than nothing. The milk should be drawn with clean, dry hands. The cows having previously been cleaned, the udders and flanks should be wiped with a moist cloth preparatory to milking, or, better still, washed and thoroughly dried.

In experiments made by Stocking, only 716 bacteria per cubic centimeter were found in milk drawn after udders and flanks of cows had been wiped with a damp cloth, while 7,058 bacteria per cubic

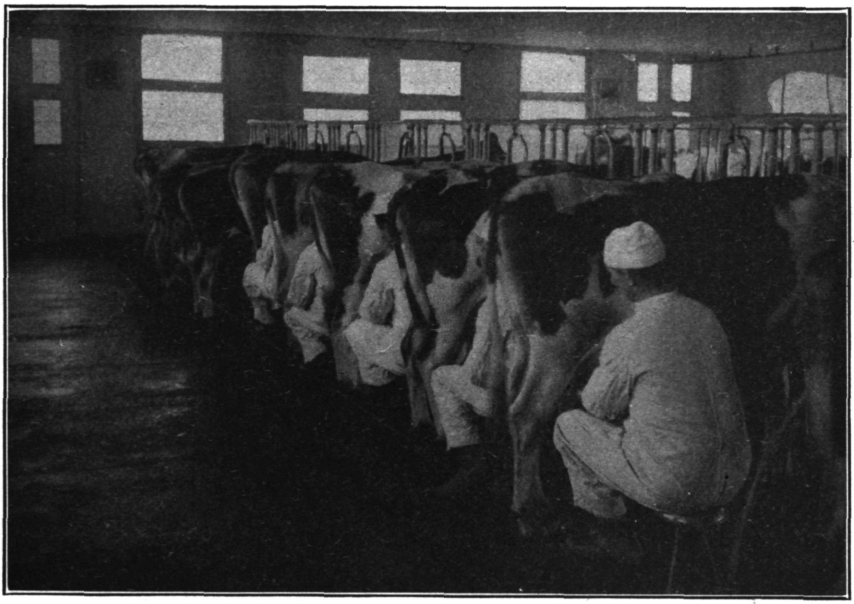

FIG. 62.—Milking cows under clean and sanitary conditions.

centimeter were found in milk from cows not so wiped before milking.

It is important that the air in the stable be free from dust and odors during milking.

HANDLING THE MILK.

The milk should be removed from the stable after each cow is milked, and cooled immediately to a temperature below 50° F., if possible. If not convenient to cool the milk until a can is filled, it should at least be removed from the stable and not allowed to stand exposed to the stable air. The quicker it is cooled the longer it will keep sweet.

The importance of promptly cooling milk is well shown by figure 63, based on an experiment by Prof. H. W. Conn, of the Storrs (Connecticut) Agricultural Experiment Station. It appears that the

multiplication of bacteria in twenty-four hours in milk kept at 50° F. was only fivefold, while at 70° F. it was seven hundred and fifty fold.

The steps in handling the milk, as already given in connection with the description of a milk house, may be summarized as follows: The milk is taken up into the weigh room and poured into the strainer (A), through which it passes into the mixing tank, then falls by gravity over the cooler (B) and is transferred to the bottle filler (C). After being bottled it is stored in the refrigerator (D), or, if held in cans, it is stored in the tank (E).

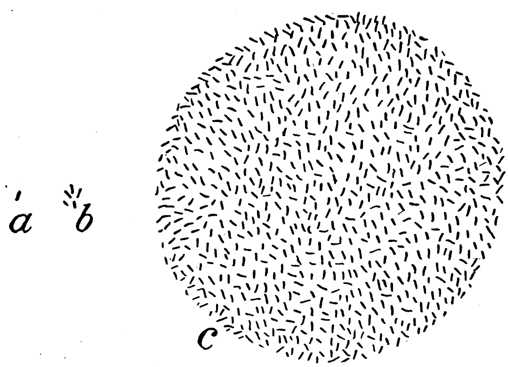

FIG. 63.—Effect of temperature upon growth of bacteria. *a*, A single bacterium; *b*, its progeny in twenty-four hours in milk kept at 50° F. (5 bacteria); *c*, its progeny in twenty-four hours in milk kept at 70° F. (750 bacteria). (From Bulletin 26, Storrs (Conn.) Agricultural Experiment Station.)

STORAGE AND TRANSPORTATION.

Milk should be stored preferably at a temperature below 50° F. This means that ice should be used. Spring water at a temperature not exceeding 55° F. will give fairly good results, provided the cooling is done immediately and there is a good flow of water in the spring where the milk is stored. It is desirable to use cracked ice in transporting the milk in summer, either on the retail wagon or to the station for shipment. If this is impossible, a jacket or wet blanket over the cans will aid in keeping the milk cool.

A DEVICE FOR MILKING DIRECTLY INTO THE SHIPPING CAN.

The every-day work of the dairyman should be made as simple as possible. The fewer the operations the less work and the less danger of contamination. Realizing the importance of saving time in dairy work, Dr. Lee H. P. Maynard, of the Dairy Division, has devised a combination milk pail, can, strainer, and stool (see fig. 64).[a] This plan does away with the milk cooler that is usually considered a necessity in the dairy. A funnel is placed in an opening made in the shoulder of a 5-gallon can, of the type that has a cover which screws in air-tight; a piece of cheesecloth is held in the funnel by means of a metal spring, and the milk can slides into a metal frame which is

[a] Application has been made for United States patent on this device under the act of Congress of March 3, 1883, so that the device may be used by the Government of the United States, or any of its officers or employees in the prosecution of work for the United States, or by any person in the United States, without the payment of royalty.

used as a stool and so constructed that the can may be adjusted to any height to suit the convenience of the milker. When the can is full all the milker has to do is to remove the funnel, screw a cap into the opening, and place the can in the storage tank. The funnel is simply washed and boiled and set away in a tin receptacle kept specially for the purpose. It is all the apparatus the dairyman has to clean if the cans are properly sterilized by the dealer. When we compare this simple apparatus with the ordinary open milk pail and wire-gauze strainer, wooden milk stool, a milk cooler (which as ordinarily kept inoculates the milk with countless bacteria), and a 10-gallon can, we find the handling of milk much simplified.

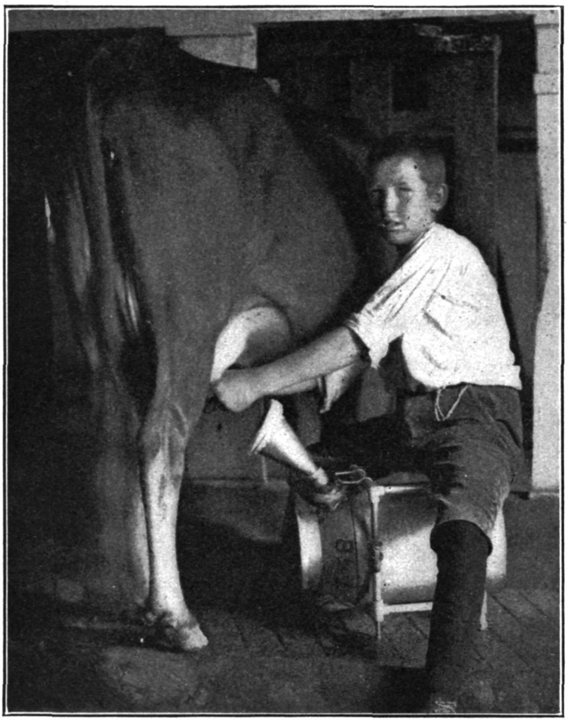

FIG. 64.—The Maynard combination milk pail, can, strainer, and stool. This simple device makes it possible to produce clean milk in almost any stable.

We do not wish to give the impression that the cooling and aerating of milk as ordinarily practiced is not important, since it is well known that the keeping quality of such milk is much improved by running it promptly over a tubular cooler, provided the cooler and surrounding air are clean. Where the Maynard pail is used, however, cooling and aerating by means of a tubular cooler are not necessary, for the reason that there are but few germs to multiply and no cow-stable odors to be removed; hence cooling in the shipping can answers all requirements and is much simpler and quicker.

LIST OF PUBLICATIONS.

The following publications, containing further information on various phases of sanitary milk production, may be obtained free of charge, so long as they are available, on application to the Bureau of Animal Industry, Department of Agriculture, Washington, D. C.:

Farmers' Bulletin 42. Facts About Milk.

Farmers' Bulletin 55. The Dairy Herd—Its Formation and Management.

Farmers' Bulletin 63. Care of Milk on the Farm.

Farmers' Bulletin 348. Bacteria in Milk.

Farmers' Bulletin 351. The Tuberculin Test of Cattle for Tuberculosis.

Bureau of Animal Industry Circular 103. Records of Dairy Cows: Their Value and Importance in Economic Milk Production.

Bureau of Animal Industry Circular 114. Sanitary Milk Production.

Bureau of Animal Industry Circular 131. Designs for Dairy Buildings.

Bureau of Animal Industry Circular 142. Some Important Factors in the Production of Sanitary Milk.

THE 1908 OUTBREAK OF FOOT-AND-MOUTH DISEASE IN THE UNITED STATES.

By A. D. MELVIN, D. V. S.,
Chief of the Bureau of Animal Industry.

Again the United States has been visited by an outbreak of foot-and-mouth disease, and again the malady has been stamped out by prompt and vigorous work by the Federal and State authorities in cooperation.

Foot-and-mouth disease, or aphthous fever, is an acute, highly infectious disease principally affecting cattle, although hogs, sheep, goats, and other animals are also susceptible, and it is sometimes communicated to man. It is characterized by fever, accompanied by the eruption of vesicles or blisters on the mucous membrane of the mouth and on the skin between the toes and above the hoofs. It spreads easily and rapidly among susceptible animals.[a]

While this disease has been quite prevalent for many years in Europe and has caused great losses there, it has reached the United States on only five occasions and each time has been promptly eradicated without being allowed to spread sufficiently to gain a foothold. The disease appeared in this country in 1870, 1880, and 1884, but none of these early outbreaks assumed serious proportions. The last and most extensive outbreak, previous to that of 1908, occurred in 1902–3 in Massachusetts, New Hampshire, Vermont, and Rhode Island.[b]

DISCOVERY OF THE RECENT OUTBREAK.

The disease was first observed early in November, 1908, near Danville, Pa., among cattle belonging to Jacob M. Shultz. Mr. Shultz had in his possession a publication of the Bureau of Animal Industry describing foot-and-mouth disease, and by comparing the symptoms in his cattle with this description he suspected that the animals might have that disease. He called in a local veterinary practitioner, Dr. J. O. Reed, who also regarded the affection as suspicious and reported the cases to Dr. Leonard Pearson, State veterinarian of Pennsylvania.

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[a] Circular 141 of the Bureau of Animal Industry describes the nature and symptoms of the disease, as well as its diagnosis and methods of prevention.

[b] A history of the 1902–3 outbreak appears in the Nineteenth Annual Report of the Bureau of Animal Industry (for 1902), p. 391.

The first news received by the United States Department of Agriculture was on November 10, from Doctor Pearson, who had examined cases near Danville and Watsontown and who gave a positive diagnosis of foot-and-mouth disease. The writer at once went to Danville, accompanied by Dr. John R. Mohler, chief of the Pathological Division, and Dr. R. P. Steddom, chief of the Inspection Division of the Bureau of Animal Industry, and after examination of some of the cases they confirmed the diagnosis.

TERRITORY AFFECTED AND MEASURES FOR SUPPRESSION.

A quarantine was declared by the Secretary of Agriculture on November 12 (effective November 13) against the interstate movement of animals from the counties of Columbia, Montour, Northumberland, and Union, in the State of Pennsylvania, these being the only counties in which the disease was reported up to that time. Within a few days, however, cases were also found in several other counties in Pennsylvania and in the vicinity of Akron, N. Y., and on November 19 the quarantine was extended to include the entire territory of those two States. This quarantine prohibited the interstate movement or the exportation of cattle, sheep, and other ruminants and swine from either of the States named. Shipments were permitted by rail through those States provided the cars were sealed by the Bureau of Animal Industry before they entered the quarantined territory. Such shipments were allowed to be unloaded in transit only in pens designated by the Chief of the Bureau and which had been cleaned and disinfected. The shipment of dressed carcasses from the States named was permitted only when the hides and hoofs had been removed, and the shipment of hides, skins, hoofs, hay, straw, etc., was forbidden unless such material had been disinfected under the supervision of the Bureau.[a]

On endeavoring to trace the origin of the disease it was found that it was carried into Pennsylvania by two lots of cattle which came through the stock yards at Buffalo, N. Y. It was at first suspected that the contagion might have come from Canada, but on further investigation the cattle in the two shipments were found to have come from points in Michigan, New York, and Ohio, as well as in Canada. A few days later a suspicious disease was reported in several herds near Detroit, Mich., and inspectors of the Bureau of Animal Industry were sent to investigate. The Secretary of Agriculture and the writer went to Buffalo to give personal attention to the situation, and from there went to Detroit. On their arrival at Detroit the reports from the inspectors were of such a positive nature that a quarantine of the State of Michigan was declared by the Secretary on November 25.

[a] The full text of the quarantine regulations (B. A. I. Orders 155 and 156 and amendments) appears in the appendix to this volume, pp. 472–479.

A few days later the disease was also found near Lineboro, Carroll County, Md., just over the Pennsylvania border, and a quarantine was placed on the State of Maryland on November 27.

The areas in which the disease was found are shown on the accompanying map (fig. 65) and are as follows:

In Pennsylvania, the counties of Chester, Clinton, Dauphin, Delaware, Juniata, Lancaster, Lehigh, Lycoming, Montgomery, Montour, Northumberland, Philadelphia, Snyder, Union, and York.

In New York, the counties of Erie, Genesee, Monroe, Niagara, and Orleans.

In Michigan, the counties of Oakland and Wayne.

In Maryland, Carroll County.

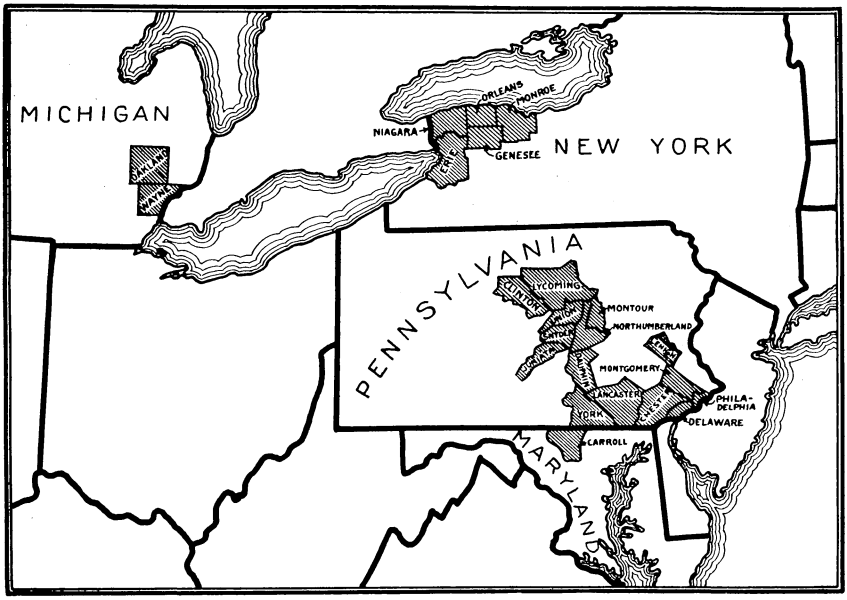

FIG. 65.—Map showing areas affected with foot-and-mouth disease.

Promptly after the discovery of the disease in Pennsylvania an arrangement was made for cooperative work by the Federal and State authorities for its eradication, and similar arrangements were later made with the authorities of the other affected States. The plan followed for stamping out the disease was practically the same as that which had been successful in the case of the New England outbreak of 1902–3, namely, to enforce a strict quarantine, to discover all infected animals and localities, and to slaughter and bury all diseased and exposed animals and disinfect the premises occupied by them. The owners of condemned animals were reimbursed to the extent of the appraised value, the Federal Government paying two-thirds of this amount and the State one-third. The expenses of burial, disinfection, etc., were shared in the same proportion.

Dr. S. E. Bennett, who had charge of the force of the Bureau of Animal Industry in the eradication of the New England outbreak six years before, was placed in charge of the Federal work in Pennsylvania and Maryland, and Dr. U. G. Houck was put in charge in New York and Dr. P. H. Mullowney in Michigan. The State work in Pennsylvania was carried on under the direction of the State veterinarian, Dr. Leonard Pearson, in New York under the direction of Commissioner of Agriculture R. A. Pearson, in Michigan under the direction of the State live-stock sanitary board, of which Mr. H. H. Hinds was chairman, and in Maryland under the direction of Dr. F. H. Mackie, chief veterinary inspector.

It was fortunate that in this emergency the Bureau of Animal Industry had, as a part of its regular organization, a large force of trained veterinarians, many of whom had had experience in the New England campaign, who could be promptly assigned to the work of inspection and eradication. It was also fortunate that the affected States were all provided with live-stock sanitary officials, so that prompt action could be taken, and with laws under which such a situation could be dealt with. The value and importance to the country of an efficient central organization to look after the interests of the live-stock industry was well demonstrated in this work, as was also the importance of States having proper officers and providing them with laws and funds. If it had been necessary to delay operations in order to organize a force to deal with the outbreak, the contagion would doubtless have spread in the meantime to the Middle West and probably to the range country of the far West, where its eradication would have been either impossible or attended with the greatest difficulty and expense. As it was, not a day was lost in beginning effective work, and the disease was practically confined to the areas to which it had already spread at the time of discovery.

Besides the work of slaughter, burial, and disinfection, veterinary inspectors were sent to trace all rumors of foot-and-mouth disease and to locate any probable centers of infection. A large force was maintained in the infected regions, and thorough and systematic inspections and reinspections were made of all animals from farm to farm. The Bureau of Animal Industry had engaged in the work of inspection and eradication a total of 572 employees, of whom 159 were veterinarians. Some idea of the tremendous amount of work involved in these inspections may be obtained from the following figures: In Pennsylvania the Bureau inspectors made no less than 69,836 visits to premises in 24 counties; in New York they made 24,748 visits; in Michigan, 8,393; in Maryland, 4,884. In addition 822 visits were made to various places in Ohio, Indiana, Kentucky, West Virginia, Virginia, New Jersey, Delaware, and Connecticut. The total number of visits thus made by the Bureau's inspectors in

their work of inspection was 108,683, and the total number of animals inspected, including reinspections, was 1,565,699.

The greatest precautions were taken by the inspectors to avoid spreading the contagion as they went about from place to place. These men were equipped with rubber coats, boots, hats, and gloves, and with disinfectants, and care was taken to disinfect their apparel immediately after having examined suspected animals and before proceeding to the next place. The manner in which the inspectors were dressed for this work is shown in figure 66. Typical cases of foot-and-mouth disease as found by them are shown in figures 67 and 68.

FIG. 66.—Inspectors examining cow for foot-and-mouth disease. They are equipped with rubber coats, gloves, boots, and hats, which are cleansed with disinfectants after each examination, in order to avoid spreading the contagion.

Slaughter of the diseased herds was begun just as soon as the necessary preliminary arrangements could be made, and the work of slaughter and disinfection was carried forward as rapidly as possible. The slaughtered animals were buried in deep trenches, the rule being to have the carcasses covered with at least 5 feet of earth. The trenches were dug 7 feet deep, 6 feet wide, and of a sufficient length to give each animal 2 feet of space. The usual method of slaughter was to lead the animals to the trench, which had been previously dug, and to kill them there by shooting. This plan was followed so as to avoid the danger of spreading the infection by dragging the carcasses over the ground. The hides were slashed and the carcasses cut open and covered

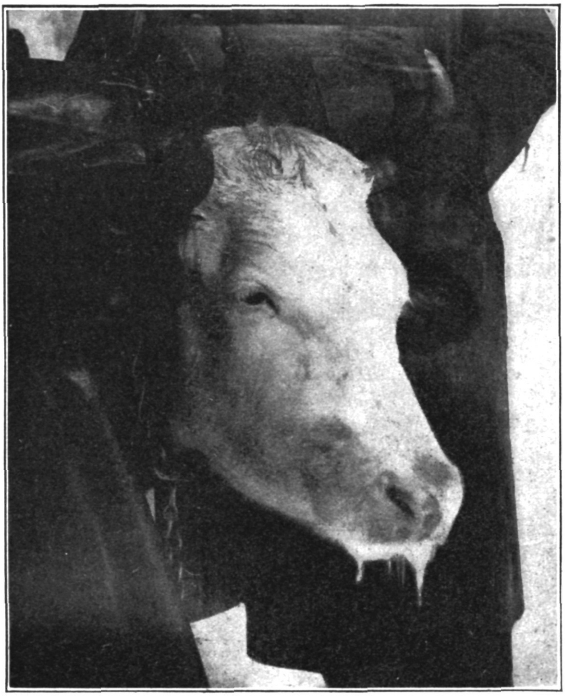

FIG. 67.—Head of cow with foot-and-mouth disease.

with quicklime. The method of slaughtering and burying cattle is shown in figure 69.

The work of disinfecting premises was difficult and tedious, but was done very carefully and thoroughly. Various methods were employed according to local conditions. Where disinfection was done on a large scale a large water tank filled with 5 per cent chlorinated lime solution was used with a steam pump, the steam being furnished in some cases by a traction engine. (See fig. 70.) In cleaning and disinfecting barns and stables the wooden fittings and flooring were, as a rule, torn out and burned, and the disinfectant was then freely sprayed over walls, ceilings, etc. Manure was turned frequently and sprayed with disinfectant continuously during the handling. Sometimes fumigation was used for the interior of barns containing large quantities of hay or other material which would have been damaged or ruined by other methods of disinfection. (See fig. 71.)

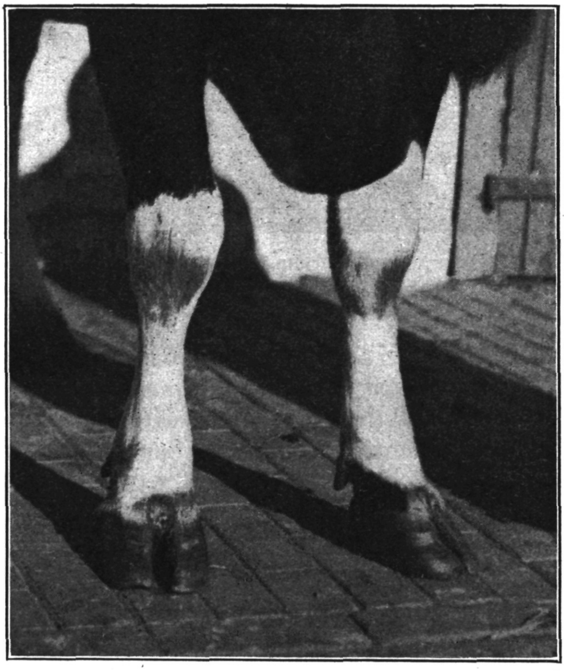

FIG. 68.—Lesions of foot-and-mouth disease on feet of cow.

A large number of railroad cars that had carried infected or suspected animals were cleaned and disinfected, also stock yards at

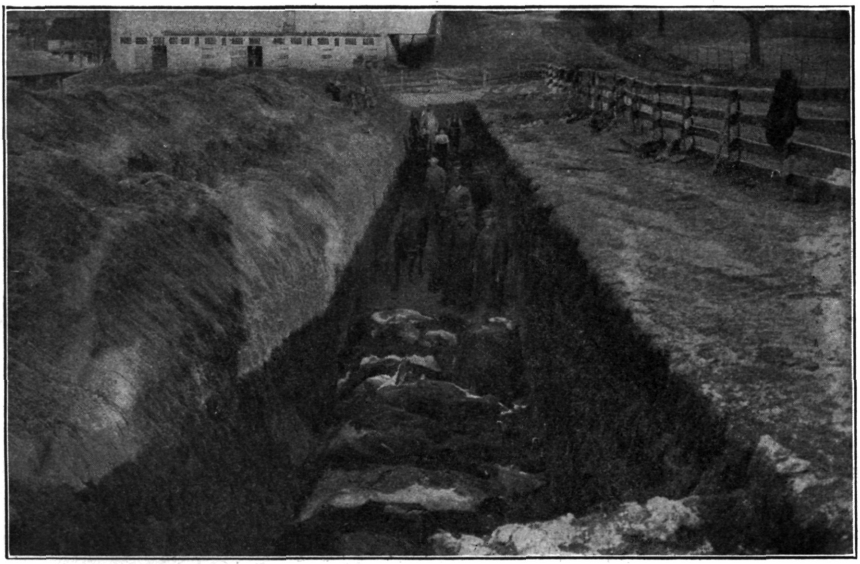

FIG. 69.—Method of slaughtering and burying cattle. The trench is deep enough to allow carcasses to be covered with at least 5 feet of dirt. Animals are led to trench and there killed, usually by shooting. Hides are slashed to prevent anyone from exhuming carcasses in order to get the hides, and carcasses are cut open and covered with quicklime.

various points in the infected areas. In disinfecting stock yards all pens and alleys were thoroughly cleaned and swept; then fences,

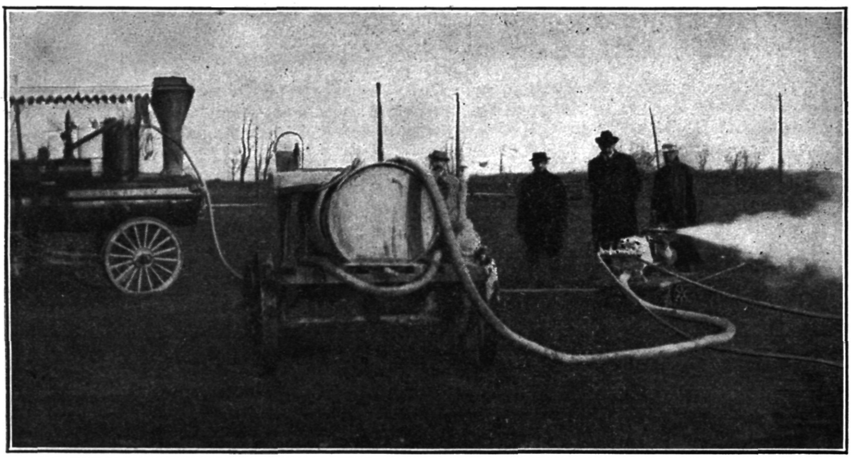

FIG. 70.—Outfit for disinfecting on a large scale. The tank contains 5 per cent chlorinated lime solution, which is sprayed by a steam pump, steam being supplied by a traction engine.

water troughs, mangers, and the ground were soaked with disinfectant. As an indication of the manner in which this work was done, it

may be said that in disinfecting the yards at Lancaster, Pa., alone, 14 tons of chlorid of lime and 50 barrels of carbolic acid were used.

So rapidly was the work of eradicating the disease carried on that by December 19, or within six weeks from the beginning, all diseased and exposed animals, so far as known up to that time, had been slaughtered and buried. The disinfection was done as promptly as

FIG. 71.—Barn prepared for fumigation. Openings covered with paper to prevent escape of gas. This method of disinfection was sometimes used when the barn contained a quantity of hay which could not be otherwise disinfected without damage.

possible after slaughter. A few additional infected herds were found later.

Diseased animals were found on 157 premises, of which 101 were in Pennsylvania, 45 in New York, 9 in Michigan, and 2 in Maryland. The number and the appraised value of the animals slaughtered in each State are shown in the following table:

Premises infected with foot-and-mouth disease, and number and appraised value of animals slaughtered.[a]

State.	Premises.	Cattle.		Hogs.		Sheep.		Goats.		Total.	
		Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Animals.	Value.
Pennsylvania	101	1,232	$49,993.94	1,000	$8,317.78	52	$346.50	4	$9.00	2,288	$58,667.22
New York	45	520	20,622.25	246	2,388.38	214	1,367.50	......	....	980	24,378.13
Michigan	9	242	5,103.00	23	202.00	9	45.00	3	9.00	277	5,359.00
Maryland	2	31	1,066.20	60	562.63	......	....	......	....	91	1,628.83
Total	157	2,025	76,785.39	1,329	11,470.79	275	1,759.00	7	18.00	3,636	90,033.18

[a] The full appraised value of animals slaughtered was paid to owners, two-thirds by the United States Department of Agriculture and one-third by the State.

The Federal quarantine was modified and partly released from time to time as condtions warranted, and was entirely removed on April 24, 1909. In view of the experience in the New England outbreak, when additional cases of the disease were found several weeks after it was supposed that eradication was complete, it was considered wise to keep the quarantine in force until sufficient time had elapsed to make it practically certain that none of the infection remained.

THE OUTBREAK DUE TO CONTAMINATED SMALLPOX VACCINE.

The origin of the outbreak was at first a mystery. As the Bureau of Animal Industry maintained a strict quarantine on imported live stock, and as the importation of ruminants from countries where foot-and-mouth disease existed was prohibited entirely, it was considered highly improbable that the infection was introduced into the country with imported animals. Various other ways in which it might have gained entrance were suggested, such as that immigrants carried the virus on their clothing, that it was brought in on hay or straw used for packing, or that it was introduced in biological products.

It soon became apparent that the outbreak started near Detroit, and when the disease was traced by inspectors of the Bureau of Animal Industry to calves that had been used in propagating smallpox vaccine by a Detroit establishment it was considered highly probable that the vaccine was contaminated with the virus of foot-and-mouth disease and that this caused the outbreak. It was therefore decided to make a thorough investigation by scientific methods to determine whether or not contaminated vaccine virus was really the cause. As the United States Public Health and Marine-Hospital Service of the Treasury Department is charged by law with the supervision of biological products used in human medicine, that Service was requested to join the Bureau of Animal Industry in making the proposed investigation, and the work was confided to Dr. John R.

Mohler, chief of the Pathological Division of the Bureau of Animal Industry, and Dr. Milton J. Rosenau, director of the Hygienic Laboratory of the Public Health and Marine-Hospital Service. A full report of their investigation has been published as Circular 147 of the Bureau of Animal Industry.

By careful scientific methods Doctors Mohler and Rosenau were able to demonstrate that the smallpox vaccine virus of the Detroit establishment was, in fact, contaminated with the virus of foot-and-mouth disease. It appeared that this firm had obtained this particular strain of vaccine in May, 1908, from a firm in Pennsylvania, and tests with the vaccine of the latter firm showed that it was likewise contaminated. While it is not positively known just how long the contamination had existed at the Pennsylvania establishment, it seems probable that it was introduced with vaccine virus imported from Japan in 1902 and that the New England outbreak of that year originated from the same source. Dr. D. E. Salmon, then Chief of the Bureau of Animal Industry, was inclined to suspect that the outbreak of 1902 might be due to contaminated vaccine, and he had inoculation tests made with the suspected vaccine at that time, but it failed to produce lesions recognized by the investigators as due to foot-and-mouth disease. The experiments of Doctors Mohler and Rosenau, however, demonstrated that animals vaccinated with the mixed virus as a rule show only lesions of cowpox or vaccinia, although the infectious principle of foot-and-mouth disease remains in the vaccinal eruption. In order, therefore, to prevent the lesions of foot-and-mouth disease from being suppressed or obscured by those of vaccinia, Doctors Mohler and Rosenau in some of their tests used calves and sheep which had been vaccinated and were therefore immune to vaccinia. By this method, and by means of intravenous inoculation, they were able to detect the contaminating infection when it might not otherwise have been disclosed.

As soon as the facts as to the contamination of the vaccine became known, immediate and effectual steps were taken by Surgeon-General Walter Wyman, of the Public Health and Marine-Hospital Service, to eradicate all this contaminated vaccine virus in America. The licenses of the two firms were at once suspended, all the contaminated or suspected vaccine virus on hand at these establishments was destroyed and all such vaccine upon the market was withdrawn and destroyed, and other radical measures were taken to accomplish the desired result. The intelligent and prompt cooperation of these firms in the work of tracing, withdrawing, and destroying the vaccine is commended. After examining every strain of vaccine virus upon the market the Public Health and Marine-Hospital Service gives assurance that there is now upon the market no vaccine virus contaminated with the virus of foot-and-mouth disease.

Hereafter manufacturers of vaccine for human use will be required to test their virus for the presence of foot-and-mouth infection as well as other infections, and regulations have been issued by the Public Health and Marine-Hospital Service with the specific object of preventing the importation or the sale in interstate traffic of vaccine virus contaminated with foot-and-mouth disease or other infections communicable to man. It is highly important that similar control should be given by law to the Secretary of Agriculture over biological products intended for the treatment of domestic animals. While the Public Health and Marine-Hospital Service has power under existing law to guard against contaminated biological products for use in human medicine, there remains the danger that contagious diseases may be brought in with veterinary preparations which are not regulated in the same manner, and this danger increases with the growing use of serums and vaccines in veterinary medicine.

ORIGIN AND SPREAD OF THE DISEASE.

The principal circumstances as to the origin of the outbreak and the spread of the infection are shown in the accompanying diagram (fig. 72), and may be summarized as follows: A Pennsylvania firm imported certain vaccine virus which has proved to have been contaminated with the infection of foot-and-mouth disease. This importation probably came from Japan as far back as 1902, and the foot-and-mouth contamination evidently persisted at the establishment until recently. In May, 1908, a Detroit firm procured some of the Pennsylvania firm's vaccine and on September 23 and October 26 vaccinated certain calves with it. These calves were obtained from Shaw Brothers, who had a farm near Detroit, under a contract by which they furnished calves to the second firm for vaccination purposes, the calves to be returned after the vaccine pulp had been removed. Shaw Brothers received a rental price for each animal and subsequently disposed of them to the public. The calves used in this instance were returned to Shaw Brothers by the vaccine firm on October 16, on which date they were driven to a commission company's pens in the Detroit stock yards, watered and fed for two hours, and then taken to a town 15 miles distant, where they were dispersed. The appearance of foot-and-mouth disease among these animals, although not then recognized as such, was observed on October 18 by Mr. I. W. Shaw, who purchased ten of them, and by other purchasers about the same time.

A shipment of three carloads of healthy cattle from uninfected farms in Michigan reached the Detroit stock yards October 20 and was placed in the same pens that had been occupied on the 16th by the vaccine calves. All but 32 of these cattle were sold and slaughtered in Detroit, and the remainder were reshipped to East Buffalo October

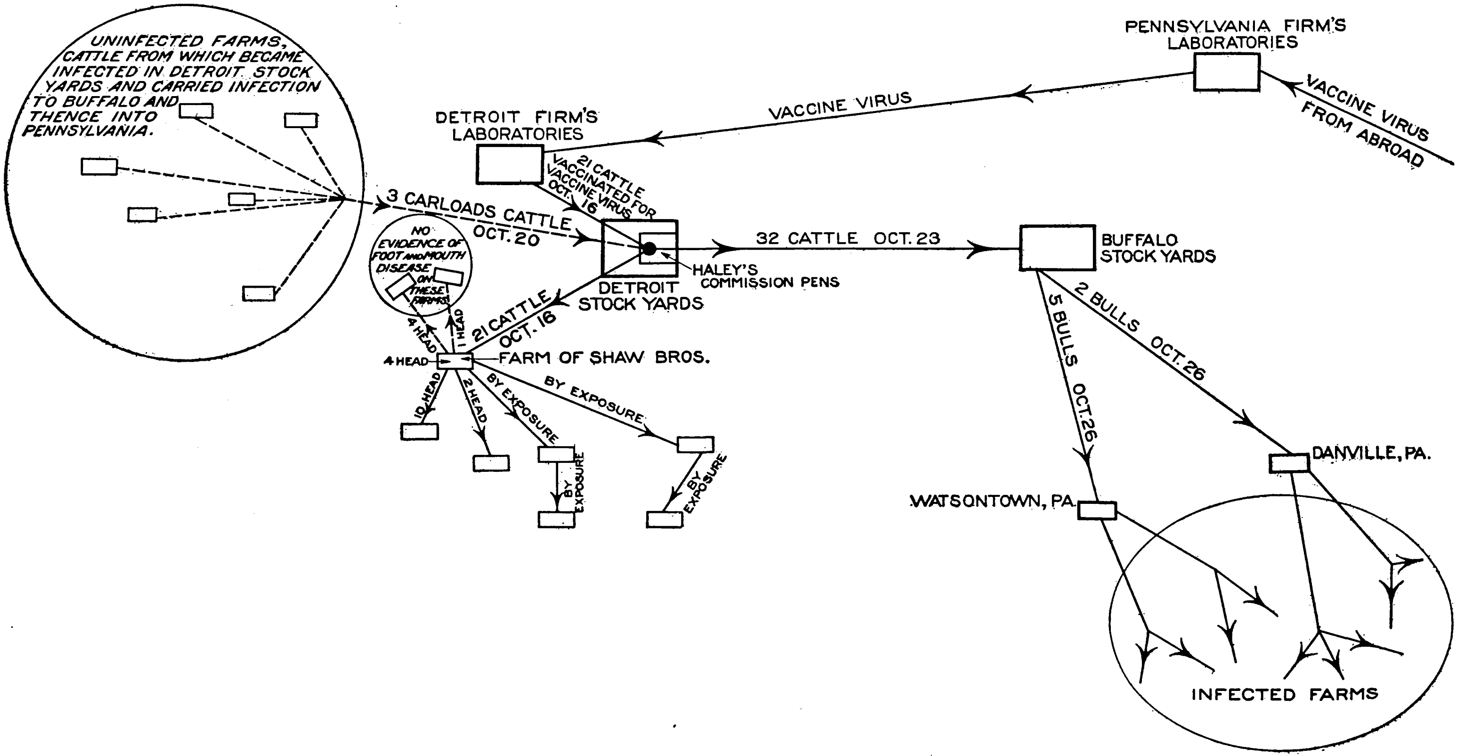

FIG. 72.—Diagram showing how infection of foot-and-mouth disease was spread.

23 and carried the contagion from the infected pens to the Buffalo yards. These animals, with others, were reshipped to Danville and Watsontown, Pa., where the disease afterwards appeared. From Buffalo the disease also spread to other points in the States of New York and Pennsylvania. The outbreak in Maryland was due to cattle shipped from Buffalo to Glenrock, Pa., and there sold at public sale November 2, 1908.

COST OF ERADICATING THE DISEASE.

The cost to the United States Department of Agriculture of eradicating the disease was just kept within the special appropriations aggregating $300,000 made by Congress for that purpose, the expenditures charged against those appropriations amounting to $299,112.10. If there should be added to this a proportionate share of the Bureau's general expenses paid from other appropriations—as, for instance, salaries of certain employees who were paid from regular appropriations, but who gave more or less of their time to this work in connection with their regular duties, also supplies and incidental expenses paid for from regular appropriations—the total cost of the Federal work would be increased somewhat beyond $300,000. If the disease had not been so promptly suppressed and if further cases had been found it would have been necessary to ask Congress for additional funds in order to continue the fight against the contagion.

The authorities of the four affected States report that they expended in their part of the work about $113,000, as follows: Pennsylvania, about $78,000; New York, at least $30,000; Michigan, nearly $4,000; Maryland, $911.90.

The loss to the dairy and stock-raising industries and to commerce was heavy. Many dairymen were put out of business for a time, and not only was interstate traffic in live stock, hides, hay, straw, etc., interfered with, but exports to foreign countries, especially to Great Britain, were seriously curtailed.

COMMENDATION OF EMPLOYEES.

The fidelity, energy, and fine spirit of self-sacrifice shown by the members of the Bureau force who were engaged in the eradication of the disease can not be too highly commended. These men deserve to be mentioned by name, but the list would be too long. Men engaged in the regular work of the Bureau in various parts of the country were hurriedly ordered to the infected regions, and such orders met with prompt and cheerful obedience, even though in many cases the circumstances were such as to cause great inconvenience and hardship and sometimes financial loss. The work was arduous

and often disagreeable, the hours were long, the accommodations sometimes uncomfortable and the food unsatisfactory, and many of the men had to spend the Christmas season away from their homes and families. And yet each one seemed to feel his duty and responsibility, and the work was done faithfully, cheerfully, intelligently, thoroughly, and rapidly. The stock raisers and the commercial interests of the country are under a heavy debt of obligation to these public servants whose fine work kept the losses to a minimum and prevented the spread of the disease to other parts of the country where the damage would have been enormous.

COMPARISON OF LAST TWO OUTBREAKS.

It is interesting to compare the recent outbreak of foot-and-mouth disease with that which occurred in New England in 1902–3. In the New England outbreak cases were found in 12 counties in 4 States, namely, Massachusetts, New Hampshire, Vermont, and Rhode Island. In the outbreak of 1908 the infection was distributed over a much larger region, comprising 23 counties in the 4 States of Pennsylvania, New York, Michigan, and Maryland. A larger number of animals were slaughtered, however, during the New England outbreak, namely, 4,461, as against 3,636 in the recent outbreak. Although the disease was of a somewhat mild type, the later outbreak was a much greater menace to the live-stock interests of the country, as it penetrated farther into the interior and came closer to the great stock-raising regions.

CONCLUSION.

When we consider the enormous losses caused by foot-and-mouth disease in countries where it has gained a foothold and that some of the European governments have struggled with it unsuccessfully for years, our own country is to be congratulated on the fact that every outbreak here has been promptly stamped out with comparatively slight damage. So quickly and effectively has the work been done that it is doubtful if many of our people realize the magnitude of the danger that has threatened our live-stock industry.

The results have shown the wisdom of the rigorous slaughtering policy adopted in this country. Such methods might be impracticable if the disease became so widespread that slaughter would involve the destruction of too large a part of the country's supply of live stock; but so long as the infection is restricted to a comparatively small part of the country's area there is no question that the slaughter policy is the best. To temporize with a restricted outbreak by relying entirely upon quarantine and treatment would very probably allow infection to spread beyond control, with disastrous results.

MISCELLANEOUS INFORMATION CONCERNING THE LIVE-STOCK INDUSTRY.[a]

THE LIVE-STOCK MARKET IN 1908.

The main feature of the live-stock market situation in 1908 was the continued scarcity and high prices of beef cattle. The table of average prices of animals at the Chicago Stock Yards (on page 395) shows that the other food animals—hogs, sheep, and lambs—all averaged less in the quotations than they did in 1907, but the high prices of 1907 mounted still higher for all classes of cattle. Excluding International show cattle, the highest point reached by native steers in 1908 was $8.40 per hundredweight in June, in which month also both the heifer and range steer classes touched their high mark, $7.50. The yearly average for cattle was 30 cents higher in 1908 than in 1907. On the other hand, the annual average for hogs fell 45 cents a hundredweight, while sheep fell 60 cents and lambs 70 cents.

The decrease in the cattle supply not only restricted the home markets; it seriously undermined the foreign trade as well, as is more fully explained later on in the section dealing with imports and exports.

There are a number of things that point to the scarcity of the beef supply in 1908, namely: (1) The decrease in the nation's stock of beef cattle; (2) decrease in the receipts of cattle at principal stock centers; (3) decrease in the number of cattle inspected at slaughter by Government inspectors; (4) increase in price of live cattle; (5) increase in wholesale price of dressed beef; (6) increase in price of feed.

More specific information regarding the above points will be briefly stated as follows:

1. The annual estimates of the Bureau of Statistics, Department of Agriculture, show that the decrease in beef cattle in the last two years amounted to 2,187,000 animals.

2. Total receipts of cattle at Chicago in 1908 were 3,039,206, as against 3,305,314 in 1907. At Kansas City the figures were 2,154,338 in 1908 and 2,384,294 in 1907. Reports from other centers tell the same story.

3. The total number of cattle slaughtered under Government inspection in 1908 was 7,279,271; in 1907 the number was 7,633,365.

[a] Compiled mainly by John Roberts, of the Editorial Office, Bureau of Animal Industry.

This decrease is all the more striking because the inspection was conducted at a larger number of establishments in 1908 than in 1907.

4. The annual average price of native steers at Chicago for 1908 was $6.10 per hundredweight, the average for 1907 being $5.80 (see page 395 for this and other prices).

5. Wholesale prices of dressed beef at Chicago and New York were much higher throughout last year than they were in 1907 (see page 398 for monthly prices of beef at these cities).

6. The high price of feed naturally has a deterrent effect on the fattening industry. As an example of the high prices it may be stated that contract corn ranged between 56 and 82 cents in 1908, whereas the range for the previous year was 39¾ to 66½ cents.

The foregoing facts seem to indicate unmistakably that there was considerably less beef produced in 1908 than formerly. When, therefore, we have a continuous increase in the number of home consumers and no corresponding increase in the supply, but a decided decrease instead, it is inevitable that a rapid change in the market status of the product must come about.

It may be of interest to quote here the annual estimates by the Bureau of Statistics, Department of Agriculture, showing the total number and valuation of the different classes of farm animals in the country. From these it appears, as above pointed out, that "other cattle" (beef cattle) have steadily declined in the last two years, whereas, with the single exception of swine on January 1, 1909, all the other classes of animals have uniformly increased. The magnitude of our national live-stock interests is well illustrated in the last column of the table, which shows that the total valuation of animals on farms January 1, 1909, reached the enormous sum of $4,525,259,000. The estimated numbers of farm animals for the last three years, together with the latest valuation, are as follows:

Estimated annual number of farm animals in the United States, 1907 to 1909, with valuation for 1909.

Farm animals.	Number January 1—			Valuation January 1, 1909.
	1907.	1908.	1909.	
Horses	19,747,000	19,992,000	20,640,000	$1,974,052,000
Mules	3,817,000	3,869,000	4,053,000	437,082,000
Milch cows	20,968,000	21,194,000	21,720,000	702,945,000
Other cattle	51,566,000	50,073,000	49,379,000	863,754,000
Sheep	53,240,000	54,631,000	56,084,000	192,632,000
Swine	54,794,000	56,084,000	54,147,000	354,794,000

MARKET PRICES OF LIVE STOCK.

The series of tables next following shows the prevailing prices paid for live stock at Chicago, the principal stock center. The first statement gives the average prices of the various classes of food animals by months for 1908 and annually for a series of years. The other

tables show the high and low range of the quotations, also prices of the different market classes of horses.

Average prices, per hundredweight, of live stock at Chicago in 1908, by months, and annual average, 1897–1908.

[From the Weekly Live Stock Report.]

Month.	Cattle. Native steers.	Cattle. Cows.	Cattle. Range steers.	Hogs.	Sheep.	Lambs.
January	$5.30	$3.70	....	$4.40	$4.80	$6.80
February	5.40	3.80	....	4.45	5.10	6.70
March	6.00	4.15	....	5.00	5.90	7.20
April	6.50	4.70	....	5.85	5.70	7.25
May	6.60	4.90	....	5.50	5.40	6.65
June	6.90	4.75	....	5.80	4.65	5.75
July	6.45	4.15	$4.90	6.50	4.05	6.20
August	6.00	3.90	4.80	6.55	3.80	6.05
September	5.95	3.75	4.70	6.85	3.75	5.35
October	5.70	3.65	4.70	5.95	4.05	5.50
November	5.90	3.50	5.05	5.80	4.20	5.85
December	6.00	3.70	4.90	5.65	4.30	6.70
Annual average:						
1908	6.10	4.10	4.85	5.70	4.65	6.35
1907	5.80	3.85	4.50	6.15	5.25	7.05
1906	5.30	3.70	4.40	6.25	5.20	6.85
1905	5.05	3.65	3.80	5.25	5.00	6.80
1904	4.95	3.55	3.65	5.15	4.25	5.60
1903	4.80	3.95	3.65	6.00	4.00	5.45
1902	6.20	4.70	4.95	6.80	4.20	5.50
1901	5.25	4.05	4.55	5.85	3.80	4.80
1900	5.15	4.05	4.35	5.05	4.55	5.90
1899	5.30	3.55	4.60	4.05	4.35	5.50
1898	4.65	3.40	4.20	3.85	4.25	5.35
1897	4.50	3.05	3.90	3.70	3.85	4.95

Range of prices, per hundredweight, of cattle at Chicago in 1908, by months, and annual range, 1897–1908.

[Compiled from report of Union Stock Yard and Transit Company.]

Month.	Native steers (1,500–1,800 pounds).	Native steers (1,200–1,500 pounds).	Poor to best cows and heifers.	Native stockers and feeders.	Texas and western steers.
January	$5.40– 6.40	$4.30– 6.35	$2.60–5.60	$2.00–4.80	$4.00–4.40
February	5.25– 6.25	4.50– 6.10	2.65–5.65	2.00–5.00	4.50–4.75
March	5.55– 7.35	4.75– 7.35	2.85–6.70	2.25–5.30	4.25–4.75
April	6.35– 7.40	5.40– 7.40	3.10–6.75	2.50–6.05	4.00–5.60
May	6.50– 7.40	5.50– 7.35	3.20–6.90	2.50–5.85	3.75–6.85
June	6.90– 8.40	5.50– 8.40	3.10–7.50	2.50–5.45	3.75–7.50
July	6.85– 8.25	4.80– 8.25	2.75–6.75	2.30–5.00	3.60–7.10
August	6.80– 7.90	4.20– 7.80	2.75–7.40	2.25–4.85	3.75–6.50
September	6.70– 7.75	4.00– 7.85	2.80–7.00	2.10–5.00	3.40–6.40
October	6.00– 7.60	4.00– 7.50	2.65–6.50	2.00–4.90	3.40–6.50
November	6.20– 7.85	4.00– 8.00	2.55–7.00	2.25–5.00	3.85–6.60
December	6.40– 7.85	4.50– 8.00	2.70–7.00	2.30–5.15	4.25–5.95
Annual range:					
1908	5.[illegible]– 8.40	4.00– 8.40	2.55–7.50	2.00–6.05	3.40–7.50
1907	5.30– 8.00	3.95– 7.50	2.35–6.25	2.00–5.35	3.00–6.75
1906	4.75–10.50	3.90–17.00	2.40–6.60	1.75–5.10	2.90–6.35
1905	4.40– 8.65	3.00– 8.45	2.25–6.80	1.50–5.45	2.60–5.25
1904	4.35–10.50	3.35–12.25	2.00–7.50	1.50–5.50	2.40–5.65
1903	4.10– 7.55	3.35– 8.35	2.50–5.50	1.50–5.20	2.55–5.10
1902	4.25–14.50	3.60– 9.00	3.35–8.25	1.90–6.00	2.55–7.65
1901	4.75– 9.30	3.60–12.00	2.00–8.00	1.65–5.15	2.75–5.75
1900	4.70–15.50	3.90–11.00	1.75–6.00	2.10–5.25	3.00–5.90
1899	4.60– 8.50	4.00– 8.25	2.00–6.85	2.50–5.40	3.10–6.75
1898	4.10– 6.25	3.80– 6.15	2.00–5.40	2.50–5.40	3.15–5.40
1897	4.00– 6.00	3.35– 6.00	1.75–5.40	2.40–4.75	2.75–4.90

Thursday, December 3, 1908, fifty-three carloads of International Exposition "show" cattle sold in the auction at $7 to $13, or an average of $9 per 100 pounds, the highest on record. Forty-nine loads of "fat" steers averaged $9.12; three loads of "short-fed" steers went at $7 to $7.70 and a load of heifers $8. Twenty-seven of the fifty-three loads were yearlings which averaged $9.35.

Range of prices, per hundredweight, of hogs at Chicago in 1908, by months, and annual range, 1898–1908.

Month.	Heavy packing (250–500 pounds).	Mixed packing (200–250 pounds).	Light bacon (150–200 pounds).
January	$4.00–4.70	$4.00–4.72½	$3.95–4.62½
February	4.00–4.70	4.05–4.70	4.00–4.60
March	4.15–6.30	4.15–6.35	4.15–6.32½
April	5.00–6.40	5.05–6.45	5.00–6.40
May	5.00–5.85	5.05–5.90	5.05–5.85
June	5.05–6.67½	5.15–5.65	5.10–6.60
July	5.75–7.10	5.75–7.07½	5.60–6.95
August	5.80–7.10	5.90–7.10	5.60–7.05
September	6.15–7.60	6.20–7.50	6.05–7.40
October	5.10–7.20	4.85–7.15	4.70–7.00
November	5.20–6.40	5.05–6.35	4.65–6.20
December	5.25–6.15	5.10–6.10	4.60–6.00
Annual range:			
1908	4.00–7.50	4.00–7.50	3.95–7.40
1907	3.75–7.25	3.70–7.22½	3.70–7.17½
1906	5.00–7.00	4.95–7.10	4.90–7.00
1905	4.35–6.40	4.25–6.42½	4.10–6.45
1904	4.10–6.30	4.15–6.37½	4.00–6.30
1903	3.85–7.87½	3.90–7.80	3.90–7.70
1902	5.70–8.25	5.65–8.20	5.40–7.95
1901	4.80–7.37½	4.85–7.30	4.75–7.20
1900	4.15–5.85	4.15–5.82½	4.10–5.75
1899	3.35–4.95	3.40–5.00	3.30–5.00
1898	3.10–4.80	3.10–4.70	3.10–4.65

Average weight of hogs, 1908, 218½ pounds.

Nine carloads of international exposition "show" hogs sold in the auction Thursday, December 3, 1908, at $6.10 to $7, or an average of $6.58 per 100 pounds for the nine loads.

Range of prices, per hundredweight, of sheep at Chicago in 1908, by months, and annual range, 1898–1908.

Month.	Native sheep (60–140 pounds).	Native yearlings and lambs.	Western sheep (70–140 pounds).	Western and Mexican lambs.
January	$2.50–5.75	$5.00–7.40	$3.00–5.75	$5.50–7.40
February	2.50–5.75	5.25–7.15	2.75–5.65	4.75–7.15
March	3.25–7.00	5.50–7.75	3.50–7.00	5.50–8.35
April	3.00–7.00	5.00–7.70	3.00–7.00	5.00–8.00
May	3.00–6.75	4.40–7.15	2.00–6.65	4.50–7.75
June	2.50–5.60	3.75–6.75	3.40–5.60	3.75–6.70
July	2.50–5.25	3.50–7.10	2.50–4.75	4.25–7.25
August	2.25–5.50	3.50–6.85	2.25–4.75	5.10–6.85
September	2.00–5.15	3.25–6.00	2.00–4.75	4.00–6.15
October	2.00–5.25	3.75–6.65	2.00–5.25	4.50–6.55
November	2.00–5.50	4.00–6.75	2.60–5.10	4.50–6.65
December	2.25–5.25	4.25–7.85	2.75–5.50	4.75–7.75
Annual range:				
1908	2.00–7.00	3.25–7.85	2.00–7.00	3.75–8.35
1907	2.00–7.00	4.00–8.60	2.00–7.25	4.00–9.25
1906	3.00–6.50	5.00–8.50	3.00–7.00	4.75–11.25
1905	2.75–6.35	4.00–8.25	3.15–6.35	4.50–8.20
1904	1.50–6.00	2.50–7.75	2.00–5.80	3.00–7.50
1903	1.25–7.00	2.50–8.00	2.00–7.00	2.50–7.90
1902	1.25–6.50	2.60–7.25	1.25–6.30	2.50–7.60
1901	1.40–5.25	2.00–6.25	1.50–5.25	2.75–5.90
1900	2.00–6.50	3.00–7.60	3.00–6.50	4.00–7.60
1899	2.25–5.65	3.50–7.45	2.50–5.55	4.00–7.00
1898	2.00–5.25	3.50–7.10	3.00–5.25	3.75–6.75

Six loads of international exposition "show" lambs sold in the auction Thursday, December 3, 1908, at $7.25 to $11, or an average of $9.20. A load of show sheep sold at $6, a load of yearlings at $6.50, and another load at $10.

MEAT PRICES AT HOME AND ABROAD.

The series of tables which follow have been compiled with the view of showing how the prices of the different kinds of meat compare at the principal American and European markets. For this purpose five large cities have been selected—Chicago, New York, London, Paris, and Berlin—and the wholesale prices noted of a representative high grade of each class of meat at monthly intervals covering the last two years. It is intended that the grade for which the price is quoted shall be as nearly as possible the same in all cases, so as to effect as true a comparison as is practicable.

The quotations include the five classes of meats in common use, namely, beef, veal, mutton, lamb, and pork. The prices have been obtained from standard trade papers of the various cities, and the European data have been converted at authorized rates into the United States equivalents in pounds and cents. The prices for Berlin and Paris are for the first Saturday in each month; those for London are for the preceding Friday; those of New York for the preceding Thursday; and those of Chicago for the preceding Tuesday. No closer uniformity could be secured with the trade papers quoted from.

BEEF.

A sharp rise occurred in beef prices at Chicago and New York in the spring of 1908, and afterwards values were generally much higher throughout the year than they were in 1907. The high mark for 1908 was in May, when the price touched 12½ cents a pound at Chicago, this being 4 cents higher than the corresponding price in 1907. The table shows the singular fact that the New York prices in 1908 were as a rule a shade lower than those of Chicago.

Regarding the British prices it is significant that, taking the year through, the port-killed American beef has rated slightly higher than English beef. This speaks well for its quality. The high price, however, must be partly ascribed to scarcity. A comparison of the Chicago and London figures shows clearly that it did not pay to export beef during the greater part of the year. The October quotation, for instance, was actually higher for Chicago than for London. There was, in consequence, an enormous falling off in the exports, as is more fully explained in the section dealing with foreign trade (p. 402).

Berlin beef prices were lower in 1908 than in 1907. They are nevertheless still much higher than those of the other cities in the table. Paris prices were also lower in the early part of 1908 than in the same period of 1907, but in the summer months the conditions were reversed. In the last three months of the year they dropped again to the same level as 1907. It will be noticed that the Paris quotations are for hind quarters, there being none for whole carcasses. Hind quarters usually

rate about 1½ cents a pound above the price for the whole side, and this deduction should be made in comparing the French prices with the others.

Wholesale prices per pound of fresh carcass beef at home and foreign markets, 1907 and 1908, by months.

Date.		Chicago.	New York.	London.		Berlin.	Paris.
		Good native steers, carcass.	Choice native steers, heavy carcass.	English beef.	American (London killed).	Fat oxen.	Hind quarters.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1908	9¼	9¾	11 –11¼	10¼–11¼	17¾–18⅜	8¾–14
	1907	7– 8½	9¾	11⅛–11⅝	10⅛–11⅜	18 –18½	7 –14
February	1908	9¾	9¼	10¾–11¼	10½–11	16⅝–17¼	8 –13⅛
	1907	7½– 8½	8¾– 9½	10⅝–10⅞	10⅞–11⅜	17 –18	9¾–14
March	1908	9½	9	10½–10¾	10¼–11	15¾–16⅜	8 –13¾
	1907	7½– 8½	9 – 9¼	11⅛–11⅜	10⅜–11⅛	16½–17¼	8 –13¾
April	1908	10	11½	11 –11½	10¾–11½	15½–16¼	8 –14
	1907	7½– 8½	9	11⅛–11⅜	10⅝–11⅝	16½–17½	10½–15¾
May	1908	11 –12½	11¾	10¾–11	10¾–11¼	15½–16¼	8 –14
	1907	8 – 8½	8½– 9¼	10⅞–11⅜	10⅜–11⅛	16½–17	9¾–15¾
June	1908	10 –10½	11¼	12½–12¾	12¼–12¾	14⅞–15¾	8¾–16⅝
	1907	8 – 8½	9	11⅝–11⅞	11⅛–11⅝	16¼–16½	9¾–15¾
July	1908	11½–12	12	11½–12¼	11½–12½	15¾–16⅞	9⅝–16⅝
	1907	8½– 9	10	11⅝–12⅛	11⅛–12⅛	16½–17	8¾–15
August	1908	10½–11	11	11¼–12¼	11½–12¾	16⅝–17¾	9⅝–15¾
	1907	8½– 9	10¾	11⅛–11⅜	10⅝–11⅝	17¼–18	8¾–15
September	1908	10 –11	10¾	10¾–11¼	10¾–12¼	17 –18⅛	10½–15¾
	1907	9½	11	11⅛–11⅝	11⅛–12⅛	17¾–18½	8¾–13¼
October	1908	10½–11½	10¾	10½–11¼	10 –11¼	17 –17⅞	8¾–14⅞
	1907	9¾	10½–10¾	10⅞–11⅛	10⅝–11⅝	17¼–18	9¾–15
November	1908	10½–11	10½	10¼–11¼	10¼–11¼	16⅜–17¼	8 –14
	1907	9¾	10¾–11	10⅝–11⅛	10⅛–11⅜	17 –17¾	8 –14
December	1908	10½–11	10¾	11½–12¼	10 –11¼	15¾–16⅝	8¾–14½
	1907	9½	10½–10¾	10⅝–11⅛	10⅝–11⅝	17 –17¾	8 –13¾

VEAL.

The Chicago veal market was steady throughout the year, and prices were generally a little lower than in 1907. New York veal also was as a rule slightly cheaper in 1908. The New York prices, it may be noticed, average 2 to 3 cents a pound higher than the Chicago prices.

London veal, on the contrary, was generally a little higher in 1908. The British prices were about on a par with those of New York toward the end of the year. Formerly they were usually from 1 to 2 cents higher.

The best Berlin veal is no doubt a choice article, but it is very expensive. In many instances the values are fully 100 per cent above those of Chicago. Compared with 1907, the Berlin prices in 1908 were lower in the early months, but appreciably higher in the summer and fall.

The Parisians are large consumers of veal. A much larger quantity comes into the market daily than of any other class of meat. Excepting the last three months, there was a considerable advance in

the prices of 1908 over those of 1907. The best French veal averages about 2 cents a pound lower than the Berlin price, but it is 2 to 4 cents higher than the London quotations.

Wholesale prices, per pound, of fresh carcass veal at home and foreign markets, 1907 and 1908, by months.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Good carcass.	Prime veal.	Best veal.	Choice whole-milk fed.	Choice.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1908	11	14–14½	16–16⅞	20½–22	19¼–21
	1907	10 –11	14	15¼–16¼	22½–23¼	19¼–20¾
February	1908	11	14–14½	13¾–15¼	19 –20⅛	18 –19¼
	1907	11½–12	14½	13⅛–14⅛	19½–20	17½–19¼
March	1908	11	14	14¼–16	17¾–18½	17½–19
	1907	11½–12	14½	13⅝–15¼	19 –20	16¾–17½
April	1908	11	13	15¼–16	18⅜–19½	16⅝–18⅜
	1907	11 –11½	14	14⅛–15¼	20¼–21¼	16¾–18½
May	1908	10½	12	13 –13¾	19½–20¼	16¼–17¼
	1907	10 –11	12	13⅛–14⅛	20¼–21¼	19 –20¼
June	1908	10	11	13¾–15¼	19 –20¼	18⅜–19¾
	1907	9 –10	13	14⅛–15¼	20¼–21	17½–18½
July	1908	10½	11–12	13⅜–15¼	19 –20⅛	16⅝–17½
	1907	9 –10	13	13⅛–14⅛	16¾–17¾	15 –16¾
August	1908	11	12–13	13 –13¾	19⅞–21	16¼–17¼
	1907	10 –11	13–14	12⅛–13⅛	18 –18¾	15 –15¾
September	1908	11½	14–14½	15¼–16	19⅝–20¾	18⅜–19¼
	1907	10 –11	13–14	12⅝–13⅝	18¾–19½	16¼–17½
October	1908	12	14–15	14¼–15⅝	19⅝–20¾	17½–19
	1907	11 –12	14–15	13⅛–14⅛	19 –19¾	18½–19¾
November	1908	11½	14	13 –13¾	20¾–21⅝	17½–19
	1907	12	14–14½	13⅛–14⅛	20½–21½	19¼–20¼
December	1908	10½	14–15	13⅜–15¼	19⅞–21⅛	17¼–18⅜
	1907	12	14–14½	13⅝–14⅝	20½–21½	18½–20¼

MUTTON.

The prices for good sheep carcasses in Chicago were very high in the first half of 1908, touching 13 cents a pound in April. There was, however, a considerable slackening later on, the lowest figure for the year being 8½ cents in October. New York mutton was usually one-half to 1 cent higher than Chicago, although the November quotation was the same and that for December half a cent lower.

London mutton was higher from January to April, 1908, than in the corresponding period of 1907, but from May onward it was from one-half to 2 cents lower in 1908.

The Berlin mutton quotations were uniformly lower in 1908 with the exception of one month, January. The prices ran about even with those of London for a considerable portion of the year, but in the later months they exceeded the British figures by about 2 cents.

The Parisians evidently regard choice mutton as their best meat, as the prices, with a few exceptions, run higher than those of lamb and veal. The table shows, also, that the quotations for 1908 were generally higher than those of 1907.

Wholesale prices per pound of fresh carcass mutton at home and foreign markets, 1907 and 1908, by months.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Good sheep.	Choice sheep.	English.	Fat wethers.	First quality.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1908	10	10	13 -14¼	15¾-16⅜	18⅜-20⅛
	1907	9	10	12⅝-13⅝	15¼-16	16¼-18
February	1908	10½	10-10½	13 -15¼	14⅞-15½	18⅜-19¼
	1907	9	9	12⅛-13⅜	15¾-16½	17½-18½
March	1908	10½	11¼	13 -15¼	14 -14¾	18⅜-19¾
	1907	9	9	12⅝-14⅛	15¾-16½	17½-18½
April	1908	13	14	13⅜-15¼	14⅛-14⅞	18⅜-20⅛
	1907	9	10	13⅛-14⅝	15 -15¾	18½-19¼
May	1908	12	13	12¼-13¾	14⅛-14⅞	16⅝-17½
	1907	10	11	13⅜-15¾	15 -16	19 -19¾
June	1908	10½	11	13 -15⅝	14⅞-15½	18⅜-19¼
	1907	10	12½	14⅛-16¼	15 -16	17½-19
July	1908	9½	10	13 -14¼	14⅞-15½	18⅜-19¾
	1907	11	10	14¼-15¾	16 -16¾	17½-18½
August	1908	9½-10	10	13 -15¼	16 -16⅞	18 -19¼
	1907	10	10½	13⅛-15¾	17¼-18¼	17½-19
September	1908	9½	9½	12¼-13¾	15½-16¼	18⅜-19¼
	1907	9-9½	11	12⅝-14⅝	17¼-18¼	16¾-17½
October	1908	8½	9	10¾-13	15½-16¼	18⅜-19¼
	1907	10	11	13⅛-14⅝	16¼-16¾	18½-19¼
November	1908	9	8½-9	11¼-13	14¾-15½	17½-19
	1907	10	11	12⅛-14⅛	15¼-16	17½-19¼
December	1908	9½	9	10¾-13	14⅛-15⅛	17¼-18⅜
	1907	10½	10½	12⅛-14⅛	15¾-16½	17½-19¼

LAMB.

Round-dressed lamb carcasses at Chicago brought 1 to 2 cents a pound more in the spring of 1908 than they did the year before, but from June on the price was one-half to 2½ cents less. The high point on the list was 15½ cents in April, the lowest figure being 11 cents in October. Choice spring lambs in New York ran pretty even with Chicago for most of the year. It is rather singular that the highest quotations for lamb in New York for the past two years occurred in June, when the price touched 16 cents in both years. This was two months later than the Chicago maximum and three months later than that of London.

The new season's lamb in England is a highly esteemed article of diet and commands very high prices. The table shows that it appears on the market from December to May. The highest prices are obtained in March, the top price in 1908—24¼ cents a pound—being the highest obtained for any class of meat at any of the markets quoted. It may be observed, however, that the London quotations for November and December, 1908, were but 1 cent higher than those of New York and Chicago.

Fat lambs at Berlin usually maintain a fairly even price throughout the year, and they average about 4 cents a pound higher than Chicago.

Choice lamb in Paris was somewhat higher in 1908 than in 1907. The highest prices are secured in the late fall and early winter, the

November, 1908, quotation touching 23⅜ cents a pound, the highest of the year.

Wholesale prices per pound of fresh carcass lamb at home and foreign markets, 1907 and 1908, by months.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Round-dressed lambs.	Choice spring lambs.	Choice native.	Fat lambs.	Choice (without head and pluck).
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1908	13	12½	*a* 19⅞–22⅞	18⅛–18½	17½–21⅞
	1907	12 –13	12 –13	....	16½–17¼	15 –19¼
February	1908	13½	12½–13	*a* 19–21¼	17 –17¼	14⅞–18⅜
	1907	12 –13	12 –12½	....	16¾–17¾	14 –18½
March	1908	13	13	*a* 19⅞–24¼	16¼–16½	14⅞–19¼
	1907	12 –13	12	*a* 20¼–23¼	16¾–17¾	14 –18½
April	1908	15½	15½	*a* 19⅞–22⅞	16⅜–16¾	14 –19¼
	1907	12 –13	14	*a* 19¼–22¼	16 –16¾	14 –19¼
May	1908	14½	15	*a* 19 –22⅛	16⅜–16¾	14 –17½
	1907	13 –13½	14½	*a* 19¼–22¼	16½–17	14 –19¾
June	1908	12½	15 –16	16⅞–21¼	16¾–17¼	15¾ 21
	1907	13½–14	16	18¼–20¼	16½–17	14 –19¼
July	1908	12½	12½	16 –19	16¾–17¼	14 –19¾
	1907	13	13	16¼–19¼	17¼–18	15 –18½
August	1908	12½	11½–12	15¼–18¼	17¾–17⅞	15¾–20⅛
	1907	13	12½	15¼–18¼	18¾–19½	14 –19
September	1908	12	12	13⅜–14¼	16¾–17¼	14⅞–20⅛
	1907	13	13½	14⅛–15¾	19 –19½	14 –18½
October	1908	11	11	13 –13¾	16¾–17¼	14⅞–21
	1907	13½	13½	14⅛–15¼	18¼–18¾	15¾–20¼
November	1908	11½	12	10¾–13	16⅜–16⅞	14⅞–23⅜
	1907	13½	12½	14⅛–15¼	18 –18¾	15 –22
December	1908	12	12	12¼–13	16 –16⅜	15¾–21
	1907	13½	12	*a* 20¼–22¼	18 –18¾	15¾–22

a New season's lamb.

PORK.

The high prices brought by dressed hogs at Chicago, which had continued without a break throughout 1907 and into the first two months of 1908, broke very sharply in March of the latter year, the price falling from 9¾ to 6¾ cents a pound. There was a gradual recovery afterwards, and in August, September, and October the figures were again at the top notch, higher even than those of 1907, but the two closing months of the year saw another decline, though of moderate dimensions. It was somewhat singular, however, that, except in the spring and early summer, Chicago prices in 1908 were higher than those of New York. The table shows that the difference in the first two months was quite marked—2½ to 3 cents a pound, or about 30 per cent.

With two exceptions—September and December—best London pork was cheaper last year than in 1907. Prices were highest in September, October, and December, and the prices for the year averaged at least 3 cents higher than Chicago.

Pork is the only comparatively cheap meat at the German metropolis. In most instances the quotations are about on a par with

those of London. Berlin prices, however, stiffened perceptibly toward the end of the year, reaching 14 cents a pound in November and December, which was 2 cents higher than in 1907.

The best French pork is quite high, averaging for the greater part of the year fully 3 cents a pound above London and Berlin. Contrary to conditions in the latter city, the Paris prices fell off in the last two months of 1908.

Wholesale prices per pound of fresh carcass pork at home and foreign markets, 1907 and 1908, by months.

Date.		Chicago.	New York.	London.	Berlin.	Paris.
		Dressed hogs.	Dressed hogs.	Best (small and medium).	Choice (medium weight).	Choice.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
January	1908	9½– 9¾	7⅛	11¼–12½	12¾	14⅞–16⅛
	1907	9½– 9¾	9¼	12⅛–13⅛	13½	14½–15½
February	1908	9½– 9¾	6⅝	12¼–13	12⅛	15½–16¼
	1907	9½– 9¾	9½– 9⅞	12⅛–13⅛	12¾	14½–15¾
March	1908	6¼– 6¾	6¾	11¼–12½	11¾	14⅞–16⅝
	1907	9½– 9¾	9⅛– 9⅞	13⅛–14⅝	11¾	15 –16¼
April	1908	6¾– 7¼	8½	12¼–13	11¾	14⅞–15¾
	1907	9½– 9¾	8¾– 9½	13⅛–14⅝	11½	15¼–16¾
May	1908	7½– 8	8¾	10¾–12¼	12⅛	14 –14⅞
	1907	9½– 9¾	8⅞– 9⅜	13⅛–14⅝	10½	16½–17½
June	1908	7 – 7½	7⅞– 8	10¼–11¼	12½	15½–16¼
	1907	9½– 9¾	8½– 9	11⅝–12⅝	10¾	16¾–17½
July	1908	8½– 9	9⅛– 9¼	10¼–11¼	12¾	14⅞–15¾
	1907	9½– 9¾	8⅜– 8⅞	11⅝–12⅝	12	16¼–17
August	1908	9½–10	9⅝	10¼–10¾	13½	14⅞–16⅛
	1907	9½– 9¾	8⅝– 9¼	11⅝–12⅝	14¼	15¾–16¾
September	1908	9½– 10	9⅜	13 –13¾	13¾	14⅜–15¼
	1907	9½– 9¾	8⅞– 9⅝	12⅛–13⅛	13¾	16¼–16¾
October	1908	10 –10½	9½– 9⅝	12¼–13	13¾	14 –14⅞
	1907	9½– 9¾	8⅞– 9¾	12⅛–13⅝	13	15 –15¾
November	1908	8 – 8¾	8⅜	12¼–12½	14	13⅛–14⅜
	1907	9½– 9¾	8⅜– 9¼	12⅛–13⅛	12	15 –15¾
December	1908	8 – 8½	8¼– 8⅜	12¼–13	14 –14¼	12⅝–13½
	1907	9½– 9¾	6⅞– 7⅝	11⅛–12⅛	12	15 –16¼

OUR FOREIGN TRADE IN ANIMALS AND ANIMAL PRODUCTS.

The reports of the Bureau of Statistics, Department of Commerce and Labor, covering the calendar year 1908, show a very decided shrinkage in our foreign trade in animals and animal products, in respect to both imports and exports. It may be seen from the first table below, showing the annual values of the exports by articles for the past three years, that this branch of our trade has decreased alarmingly in the past two years. It is true that the first year in the table (1906) was the record year for animal exports; nevertheless, a decrease of $20,000,000 the next year, and a further drop of $27,000,000 in 1908, making a loss of $47,000,000 in two years, indicate that a radical change has taken place.

The figures show that the major part of these losses occurred in our meat exports, more particularly in beef. The two main items in the decrease of two years ago were bacon ($13,000,000) and live cattle ($5,000,000). In 1908 bacon recovered $5,000,000, but the beef trade underwent heavy loss; cattle on the hoof went back a further

$10,000,000 and fresh beef lost a similar amount, making a decline of $20,000,000 in beef alone. Salt pork also shrank $7,000,000.

Regarding our foreign beef trade it may here be remarked that practically all of it is with Great Britain, and for a long series of years our product held a dominating position in the English market. It may be stated also that for the last year or two the port-killed American beef had become so highly appreciated by British consumers that it rated as high on the London market as the best English grade, these being slightly surpassed only by Scotch, which tops the market. (See table of beef prices on p. 398.)

However, owing to the natural increase in the population, more and more beef is required for our home markets, and our supply has recently been diminishing, so that we have less to spare for the foreign buyer even at a high price. South American beef is, in fact, displacing ours in the British market. It is not so good, but it has the merit of being cheaper, and this has a tendency to reconcile the consumer to the change. Some of it is chilled, some frozen, mostly the latter up to the present time. The chilled consignments are, however, increasing and are reported to be steadily improving in quality. The River Plate trade, as it is called, has indeed been increasing by leaps and bounds in recent years. It must be remembered that it practically only started as recently as 1900; the chilled shipments commenced a year later and did not reach any magnitude until 1905; yet, according to a reliable British market authority, the quantity shipped in 1908 reached a total of 415,099,440 pounds, of which 270,848,544 pounds was frozen and 144,250,896 pounds chilled. For the first time in history this total exceeds the amount supplied by the United States; the total from this country, including the dead weight of the live cattle, being given as 397,368,518 pounds.

The recent rapid decline in our beef exports is no doubt due to the economic conditions at home coupled with the increased supplies in the English market from other sources, chiefly Argentina, as previously mentioned. There is little question that the fundamental cause of the situation is the shortage in our supply of beef cattle, with the resulting high prices of beef in the home markets. It has paid better to sell the meat here than to send it across the ocean, consequently a large part of the trade has been diverted into home channels. This point is strikingly illustrated in the table of beef prices on page 398. It may here be seen that the October quotation for Chicago was actually a shade higher than the corresponding price in London, both for English beef and for American port killed.

EXPORTS.

The total value of the exports of animals and animal products in 1908 was $249,088,332; those of the previous year totaled $277,150,618, and those of 1906, $296,648,466. The decline in 1908 affected a num-

ber of items in addition to the meat products already mentioned. Tallow and lard fell off, respectively, $2,500,000 and $2,000,000, while grease and soap stock decreased nearly a million and a quarter. The only items of importance to show increases were bacon and butter. The former has been alluded to previously, and although the shipments of butter increased to the extent of a million dollars over 1907, they were still far below those of 1906.

The following statement shows the values of the exports of animal origin, by articles, for the past three years:

Value of exports of animals and animal products for calendar years 1906 to 1908.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Item.	1906.	1907.	1908.
Animals:			
Cattle	$38,273,132	$33,796,425	$24,034,193
Hogs	341,232	304,464	256,938
Horses	4,914,999	3,608,119	2,893,344
Mules	914,839	907,304	823,952
Sheep	831,495	707,930	605,792
All other, including fowls	339,051	327,419	235,196
Bones, hoofs, etc	156,539	206,034	243,898
Dairy products:			
Butter	4,548,366	862,812	1,884,254
Cheese	2,628,134	1,260,480	1,270,557
Milk	1,889,795	2,548,435	1,997,689
Eggs	1,225,708	1,719,433	1,385,450
Feathers	301,980	335,137	451,267
Glue	311,173	322,939	260,956
Grease, and all soap stock	4,250,942	6,163,739	4,988,477
Hair, and manufactures	863,027	1,102,520	1,050,531
Hides and skins (other than furs)	1,877,388	1,293,380	1,437,202
Leather:			
Sole	8,062,649	6,757,306	6,398,377
Upper	22,586,643	19,158,010	19,902,133
Other	2,328,305	2,315,673	2,055,057
Meat products:			
Beef—			
Canned	3,492,189	2,352,226	1,884,940
Fresh	24,751,284	26,182,787	15,952,670
Salted, etc	4,452,362	3,293,932	3,340,964
Tallow	5,729,856	6,623,648	3,968,532
Bacon	35,886,152	22,344,365	27,829,273
Hams	20,986,356	24,213,548	24,444,747
Pork—			
Canned	586,856	362,432	492,880
Fresh	1,216,770	1,224,355	1,770,019
Salted, etc	12,907,344	15,465,072	8,630,497
Lard	57,984,829	55,518,079	53,656,222
Lard compounds and substitutes	4,801,078	6,849,445	6,061,233
Lard oil	162,786	145,034	173,854
Other animal oil	267,214	324,735	367,007
Mutton	60,445	104,994	138,183
Oleo oil	16,936,026	18,348,208	19,136,772
Oleomargarin	870,910	335,550	279,930
Poultry and game	1,401,784	1,161,789	794,533
Sausage and sausage meats	935,288	895,685	1,046,786
Sausage casings	2,920,703	3,799,904	3,602,807
All other meat products	3,595,750	3,886,604	3,306,666
Wool	67,087	20,667	34,554
Total	296,648,466	277,150,618	249,088,332

IMPORTS.

There was an unaccountably large falling off in the imports of animal products in 1908. The statement below shows the totals of 1906 and 1907 to have been within rather less than 1½ per cent of each other, whereas the total for 1908 was no less than 27 per cent behind

1907. There are only two really large items on the import list—hides and skins, and wool—and there was a heavy decline in both of these in 1908. It is seen that the three classes of hides and skins dropped collectively last year no less than $20,000,000, while wool decreased slightly over $16,000,000.

The annual values of the imports of animal products for the past three years are as follows:

Values of imports of animals and animal products for calendar years 1906 to 1908.

[Compiled from reports of the Bureau of Statistics, Department of Commerce and Labor.]

Item.	1906.	1907.	1908.
Animals:			
Cattle	$525,266	$1,111,330	$1,600,037
Horses	1,947,872	1,835,555	1,435,315
Sheep	1,132,539	1,034,740	547,954
All other, including fowls	670,149	649,135	494,539
Bones, hoofs, etc	953,138	810,863	631,967
Bristles	3,090,288	2,851,411	2,097,252
Dairy products:			
Butter	75,767	215,868	73,384
Cheese	4,874,559	5,957,972	5,627,894
Eggs	21,074	29,014	32,278
Feathers, crude	3,707,954	4,415,304	4,802,029
Glue	616,961	659,168	565,274
Grease and oils	1,351,080	1,255,573	1,267,857
Hair, unmanufactured	3,297,308	3,126,236	3,056,093
Hides and skins:			
Goatskins	32,518,896	26,565,334	18,835,098
Cattle hides	21,149,829	18,120,638	16,318,195
All other	30,216,256	32,965,087	22,500,488
Hide cuttings	1,306,295	1,514,164	1,140,997
Leather:			
Morocco skins	3,146,516	2,907,468	1,515,783
Upper leather	3,378,080	3,796,389	1,992,765
All other	704,969	548,004	710,525
Meat products:			
Sausage casings	987,566	1,950,224	2,151,618
All other	926,417	824,365	710,132
Wool	38,361,869	39,673,007	23,304,465
Total	154,960,648	152,816,849	111,411,939

THE FEDERAL MEAT INSPECTION.

The statement next following shows the total number of animals slaughtered for food under Federal supervision during the year 1908 in each city in the United States where the Government inspection is maintained. On comparing the totals with those of the previous year the salient points revealed are the decrease in the number of cattle, and, on the other hand, the marked increase in the number of hogs slaughtered.

Compared with 1907 there were 354,094 less cattle slaughtered and 66,113 less calves. This shortage of beef was, however, far more than offset by the increased number of hogs, there being 5,757,728 more in 1908 than in 1907.

The animals enumerated in the table were slaughtered at 340 different abattoirs. It may be stated, however, that the Government meat inspection is conducted at a large number of establishments in addition to these, where no slaughtering is done.

The total number of establishments supervised by our inspectors on January 1, 1909, was 810, located in 221 cities. This is an increase over the previous year of 108 establishments and 25 cities.

Further information concerning the meat inspection is given in the report of the Chief of the Bureau of Animal Industry for the fiscal year ended June 30, 1908, on pages 9–82 of this volume.

Number of food animals slaughtered under Government inspection during calendar year 1908, by cities.

City and State.	Cattle.	Calves.	Hogs.	Sheep.	Goats.
Albert Lea, Minn	661	794	5,435	218	
Allentown, Pa	10,030	464	76,684	1,588	
Alton, Ill	1,072	307	36,959	107	
Arkansas City, Kans	1,535	177	23,612	9	
Auburn, Me	803	182	23,771	1,503	
Augusta, Ga	497	264	647	70	3
Austin, Minn	790	919	242,946	828	
Baltimore, Md	45,417	4,190	617,950	22,477	2
Bangor, Me	192	241	37	24,193	
Billings, Mont	1,814	643	4,849	3,016	
Binghamton, N. Y	53	1	35	27	
Bishop, Cal	203	18	111	1,389	
Boston, Mass	55,906	83,190	1,389,082	297,675	144
Bridgeport, Conn		127	2	2	
Bridgeport, Pa	541	58	25,279		
Brightwood, Mass	1,203	908	159,994	47	3
Brooklyn, N. Y	15,168	38,285	111	194,213	2
Buffalo, N. Y	87,341	30,019	916,715	156,965	1
Burlington, Iowa	692	393	6,558	140	
Burlington, Vt	296	11	125		
Cairo, Ill	2,169	625	7,830	314	73
Cedar Rapids, Iowa	25,280	1,164	671,035	4,186	355
Charleston, Tenn			2,907		
Chattanooga, Tenn			32		
Chester, Pa	3,159	401	32,191	7,720	
Cheyenne, Wyo	1,121	95	2,893	1,362	
Chicago, Ill	1,690,931	354,673	6,778,454	3,087,073	12,266
Cincinnati, Ohio	130,434	65,758	698,922	79,510	237
Claremont, N. H	51	49	2,915	6	
Cleveland, Ohio	56,764	38,581	825,656	88,216	4
Columbus, Ohio	4,066	194	52,256	40	
Corning, N. Y	65	16,845	396	847	
Cortland, N. Y	216	11,895	16,822	4,490	15
Corydon, Ind	84	7	1,756	3	
Davenport, Iowa	184	276	50,142	5	
Dayton, Ohio	9,938	4,037	119,079	3,901	
Decatur, Ind	747	685	8,935	128	
Denver, Colo	39,210	4,824	252,300	22,702	1
Des Moines, Iowa	25,271	682	267,103		
Detroit, Mich	18,303	13,746	506,291	32,449	2
Dover, N. H		7	8	5	
Dubuque, Iowa		11	18,864		
Duluth, Minn	6,209	2,780	11,755	3,974	22
Eau Claire, Wis	128	31	42,828	362	
Elmira, N. Y		3			
Evansville, Ind	7,996	2,287	37,809	1,596	4
Fergus Falls, Minn	505	85	7,516	76	
Fort Atkinson, Wis			9,467		
Fort Madison, Iowa	350	412	57,867	161	
Fort Wayne, Ind	2,366	2,047	37,617	977	
Fort Worth, Tex	478,119	189,403	653,646	56,580	17
Greenville, Tenn			1,324		
Halfway, Md	90	66	200	27	
Hallstead, Pa	18	316	42	739	
Hamilton, Ohio	396	355	12,385	242	
Harrisburg, Pa	1,626	539	27,190	1,128	
Hartford, Conn		10			
Haverhill, Mass	639	2,417	5,003	64,975	
Houston, Tex	21,770	7,403	36,025	1,621	211
Indianapolis, Ind	181,315	34,905	1,859,990	40,229	
Jacksonville, Ill	2,529	324	31,581	458	
Jefferson, Wis	133	698	5,041	2	
Jefferson City, Tenn			750		
Jersey City, N. J	16,873	62,463	827,720	230,616	81
Kansas City, Kans	1,181,871	150,495	4,023,456	1,071,921	21,214
Kennett Square, Pa	36	81	293	11	
Knoxville, Tenn	108	7	1,946		

Number of food animals slaughtered under Government inspection during calendar year 1908, by cities—Continued.

City and State.	Cattle.	Calves.	Hogs.	Sheep.	Goats.
La Crosse, Wis	876	484	7,333	509	
Lafayette, Ind	4,950	3,344	52,888	1,165	1
Lewiston, Idaho	525	225	973	288	
Logansport, Ind	438	191	23,591	8	
Los Angeles, Cal	75,766	10,478	107,080	202,608	8
Louisville, Ky	17,325	1,584	269,331	2,466	10
Madison, Ind	411	1,026	4,013	113	
Mankato, Minn	3,306	2,857	4,844	2,820	
Marshalltown, Iowa	2,281	174	131,286	20	
Mason City, Iowa	609	348	67,276	15	
Meadville, Pa		25	165	6	
Milwaukee, Wis	64,012	76,142	1,519,384	34,462	1
Morristown, Tenn			1,748		
Nashville, Tenn	4,315	1,128	17,643	2,287	61
National Stock Yards, Ill	521,373	91,099	1,583,159	450,442	4,056
Nebraska City, Nebr	10		201,793		
Newark, N. J	14,175	12,823	649,851	55,727	
New Haven, Conn			170,308		
New Orleans, La	61,042	3,229	11,072	774	137
New York, N. Y	468,634	292,856	942,944	1,476,869	32
Ogden, Utah	4,646	475	6,680	5,826	
Oklahoma City, Okla	2,865	1,021	12,231	18	23
Olathe, Kans		23	1,681		
Ottumwa, Iowa	11,645	1,907	737,070	3,064	
Paris, Ill	194	153	3,474	6	1
Paterson, N. J	6,275	5,990	121,847	43,136	
Peoria, Ill	6,461	3,380	131,188	949	8
Philadelphia, Pa	104,080	42,809	445,587	231,038	200
Pittsburg, Kans	4,430	947	18,895	185	7
Pittsburg, Pa	49,761	35,809	395,869	57,928	2
Port Huron, Mich			18,705		
Portland, Oreg	42,655	4,531	57,516	73,915	89
Pottsville, Pa	803	277	72,960	51	
Providence, R. I		16	101,544		
Pueblo, Colo	4,836	1,918	33,391	4,338	53
Quincy, Ill	2,566	1,047	68,302	341	4
Reno, Nev	6,427	2,774	7,255	16,081	33
Richmond, Ind	2,665	2,143	10,232	452	1
Richmond, Va	2,605		98,477	62	
Rockford, Ill	1,095	290	15,845	580	
Rogersville, Tenn			266		
Saegerstown, Pa	13	24	97	1	
St. Louis, Mo	152,414	22,057	789,399	47,379	254
Salt Lake City, Utah	2,244	10	1,038	3,591	
San Antonio, Tex	2,577	2,394	3,171	15	6
San Diego, Cal	6,206	910	5,173	12,613	2
San Francisco, Cal	89,533	24,328	62,663	275,547	517
Scranton, Pa	1,135	680	24,875	4,545	
Seattle, Wash	39,743	147	101,447	78,875	
Sioux City, Iowa	150,625	5,754	1,139,697	28,872	119
Southboro, Mass			1,907		
South Omaha, Nebr	633,678	49,825	2,141,574	989,700	682
South St. Joseph, Mo	349,212	45,050	2,248,178	435,806	1,089
South St. Paul, Minn	114,544	39,912	969,857	111,192	31
Spokane, Wash	11,142	1,555	41,105	20,030	
Springfield, Ohio	379	53	5,463	34	
Stillwater, Minn			1,683		
Tacoma, Wash	30,743	2,626	53,920	62,115	860
Toledo, Ohio	2,281	195	117,833	226	1
Topeka, Kans	6,709	1,236	117,264	453	11
Trenton, N. J		386			
Troy, N. Y	2,450	95	7,482	71	
Wallace, Idaho	1,100	343	1,705	1,552	
Walla Walla, Wash	2,484	853	9,305	2,502	
Washington, D. C	15,352	11,447	139,222	32,273	23
Waterloo, Iowa	1,002	452	72,991	2	
West Newbury, Mass	1,117	943	370	145	
Wheeling, W. Va	8,062	6,653	120,156	5,618	
Whitesburg, Tenn			735		
Wichita, Kans	14,968	2,449	593,392	509	2
Wilmington, Del	6,859	1,027	13,844	3,692	
Winona, Minn	443	395	33,692	1,909	
Woods Cross, Utah	2,647	58	4,015	3,605	
Worcester, Mass			151,727		
Youngstown, Ohio	268	21	3,297	122	
Total	7,279,271	1,958,274	38,643,105	10,304,662	42,981

LIVE STOCK REGISTERED IN THE UNITED STATES.

The details given in the annexed statements have been furnished by the secretaries of the pedigree record associations, to whom acknowledgment is hereby made for the courtesy. In connection with the table of registered animals it may be of interest to know what the proportion of living registered animals of each kind is to the total number of that kind in the country. This matter was gone into at some length by the Animal Husbandman of the Bureau in the Twenty-second Annual Report, pages 294 and 295. The figures there given, which would apply without appreciable change to present conditions, show that a shade over 1 per cent of our horses, dairy cattle, and beef cattle are registered, while about one-half of 1 per cent of the sheep and hogs are similarly recorded.

Live stock registered in the United States up to June 30, 1908.

[Compiled from statements furnished by secretaries of certified pedigree record associations.]

Breed.	Number registered.		
	Males.	Females.	Total.
HORSES.			
American Trotter	48,822	164,283	213,105
Belgian Draft	3,261	643	3,904
Cleveland Bay	1,270	527	1,797
Clydesdale	....	....	13,783
French Draft	10,630	6,476	17,106
French Coach:			
French Coach Studbook of America	2,254	741	2,995
French Coach Horse Register	284	11	295
German Coach	2,341	325	2,666
Hackney	1,099	2,001	3,100
Morgan	1,779	5,532	7,311
Percheron:			
Percheron Studbook of America	6,693	6,873	13,566
Percheron Register	1,177	625	1,802
American Breeders and Importers Percheron Registry	1,498	1,103	2,601
Saddle Horse	3,303	4,925	8,228
Shetland Pony	2,933	4,448	7,381
Shire	7,105	2,724	9,829
Suffolk	206	148	354
Thoroughbred	....	....	51,652
Welsh Pony	13	20	33
ASSES.			
Jacks and jennets	1,758	1,042	2,790
CATTLE.			
Aberdeen Angus	40,836	65,526	106,362
Ayrshire	10,863	23,175	34,039
Devon	8,419	14,335	22,754
Dutch Belted	685	1,488	2,173
Galloway	14,191	19,030	32,221
Guernsey	13,371	24,782	38,153
Hereford	....	....	296,391
Holstein-Friesian	56,555	115,696	172,251
Jersey	80,719	217,146	297,865
Polled Durham	7,335	9,173	16,508
Red Polled	17,678	28,648	46,326
Shorthorn	299,000	457,903	756,903
Sussex	88	196	284
Brown Swiss	2,654	3,842	6,496

Live stock registered in the United States up to June 30, 1908—Continued.

Breed.	Number registered.		
	Males.	Females.	Total.
SHEEP.			
Cheviot			11,845
Cotswold			42,990
Dorset Horn	2,175	5,492	7,667
Hampshire Down	7,478	16,813	24,291
Leicester	4,688	6,979	11,667
Lincoln	7,426	10,566	17,992
Merino (Delaine):			
Dickinson Spanish Merino Sheep Register			10,975
National Delaine Merino Register	7,126	12,153	19,279
Merino (French)			47,693
Merino (German)	212	291	503
Merino (Spanish):			
Register of the Michigan Merino Sheep Breeders' Association	12,595	37,845	50,440
Register of the New York State American Merino Sheep Breeders' Association	7,997	12,034	20,031
Register of the Ohio Spanish Merino Sheep Breeders' Association	18,318	36,117	54,443
Register of the Vermont Merino Sheep Breeders' Association			218,659
Oxford Down			42,727
Shropshire	123,000	171,000	294,000
Southdown			23,057
HOGS.			
Berkshire			112,080
Cheshire	1,329	2,794	4,123
Chester, Ohio Improved			21,353
Duroc-Jersey:			
American Duroc-Jersey Record	11,306	27,409	38,714
National Duroc-Jersey Record	39,050	96,500	135,550
Hampshire (Thin Rind)	1,078	2,484	3,562
Poland-China:			
American Poland-China Record	69,969	172,405	242,374
National Poland-China Record	36,500	81,000	117,500
Southwestern Poland-China Record	1,122	1,650	2,772
Standard Poland-China Record	49,978	120,292	170,270
Tamworth			4,753
Yorkshire			7,922

CERTIFIED PEDIGREE RECORD ASSOCIATIONS.

Paragraph 473 of the tariff act of July 24, 1897 (amended March 3, 1903), provides that—

Any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free, whether intended to be so used by the importer himself or for sale for such purpose: *Provided*, That no such animal shall be admitted free unless purebred of a recognized breed, and duly registered in the books of record established for that breed: *And provided further*, That certificate of such record and of the pedigree of such animal shall be produced and submitted to the customs officer, duly authenticated by the proper custodian of such book of record, together with the affidavit of the owner, agent, or importer that such animal is the identical animal described in said certificate of record and pedigree: *And provided further*, That the Secretary of Agriculture shall determine and certify to the Secretary of the Treasury what are recognized breeds and purebred animals under the provisions of this paragraph.

Accordingly the Secretary of Agriculture has certified a large number of books of record of pedigrees and their publishing agencies and has prescribed regulations for them, which have been published in Bureau of Animal Industry Order 136. A list of the certified American records and associations follows:

American pedigree record associations and books of record certified by the Secretary of Agriculture.

CATTLE.

Name of breed.	Book of record.	By whom published.
Aberdeen-Angus	American Aberdeen-Angus Herdbook	American Aberdeen-Angus Breeders' Association, Charles Gray, secretary, Union Stock Yards, Chicago, Ill.
Ayrshire	Ayrshire Record	Ayrshire Breeders' Association, C. M. Winslow, secretary, Brandon, Vt.
Brown Swiss	Swiss Record	Brown Swiss Cattle Breeders' Association, C. D. Nixon, secretary, Owego, N. Y.
Devon	American Devon Record	American Devon Cattle Club, L. P. Sisson, secretary, Newark, Ohio.
Dutch Belted	Dutch Belted Cattle Herdbook	Dutch Belted Cattle Association of America, H. B. Richards, secretary, Easton, Pa.
Galloway	American Galloway Herdbook	American Galloway Breeders' Association, Robert W. Brown, secretary, Union Stock Yards, Chicago, Ill.
Guernsey	Herd Register of the American Guernsey Cattle Club.	American Guernsey Cattle Club, William H. Caldwell, secretary, Peterboro, N. H.
Hereford	American Hereford Record	American Hereford Cattle Breeders' Association, C. R. Thomas, secretary, 225 West 12th street, Kansas City, Mo.
Holstein	Holstein-Friesian Herdbook	Holstein-Friesian Association of America, Frederick L. Houghton, secretary, Brattleboro, Vt.
Jersey	Herd Register of the American Jersey Cattle Club.	American Jersey Cattle Club, J. J. Hemingway, secretary, 8 West 17th street, New York, N. Y.
Polled Durham	American Polled Durham Herdbook	Polled Durham Breeders' Association, J. H. Martz, secretary, Greenville, Ohio.
Red Polled	Red Polled Herdbook	Red Polled Cattle Club of America (Inc.), H. A. Martin, secretary, Gotham, Wis.
Shorthorn	American Shorthorn Herdbook	American Shorthorn Breeders' Association, John W. Groves, secretary, Union Stock Yards, Chicago, Ill.
Sussex	American Sussex Register	American Sussex Association, Overton Lea, secretary, Nashville, Tenn.

HORSES.

American Trotter	American Trotting Register	American Trotting Register Association, William H. Knight, secretary, 355 Dearborn street, Chicago, Ill.
Belgian Draft	American Register of Belgian Draft Horses	American Association of Importers and Breeders of Belgian Draft Horses, J. D. Conner, jr., secretary, Wabash, Ind.
Cleveland Bay	American Cleveland Bay Studbook	Cleveland Bay Society of America, R. P. Stericker, secretary, 80 Chestnut avenue, West Orange, N. J.
Clydesdale	American Clydesdale Studbook	American Clydesdale Association, R. B. Ogilvie, secretary, Union Stock Yards, Chicago, Ill.
French Coach	French Coach Studbook	French Coach Horse Society of America, Duncan E. Willet, secretary, Maple avenue and Harrison street, Oak Park, Ill.
Do	French Coach Horse Register	French Coach Horse Registery Co., Charles C. Glenn, secretary, 1319 Wesley avenue, Columbus, Ohio.
French Draft	National Register of French Draft Horses	National French Draft Horse Association of America, C. E. Stubbs, secretary, Fairfield, Iowa.
German Coach	German, Hanoverian, and Oldenburg Coach Horse Studbook.	German, Hanoverian, and Oldenburg Coach Horse Association of America, J. Crouch, secretary, Lafayette, Ind.
Hackney	American Hackney Studbook	American Hackney Horse Society, Gurney C. Gue, secretary, 308 West 97th street, New York, N. Y.
Morgan	American Morgan Register	American Morgan Register Association, T. E. Boyce, secretary, Middlebury, Vt.
Percheron	Percheron Studbook of America	Percheron Society of America, George W. Stubblefield, secretary, Union Stock Yards, Chicago, Ill.
Do	Percheron Register	The Percheron Registry Co., Charles C. Glenn, secretary, 1319 Wesley avenue, Columbus, Ohio.

Percheron	The American Breeders and Importers' Percheron Register.	The American Breeders and Importers' Percheron Registry Co., John A. Forney, secretary, Plainfield, Ohio.
Saddle Horse	American Saddle Horse Register	American Saddle Horse Breeders' Association, I. B. Nall, secretary, Louisville, Ky.
Shetland Pony	American Shetland Pony Club Studbook	American Shetland Pony Club, Mortimer Levering, secretary, Lafayette, Ind.
Shire	American Shire Horse Studbook	American Shire Horse Association, Charles Burgess, sr. secretary, Wenona, Ill.
Suffolk	American Suffolk Horse Studbook	American Suffolk Horse Association, Alex Galbraith, secretary, Janesville, Wis.
Thoroughbred	American Studbook	The Jockey Club, W. H. Rowe, registrar, 571 5th avenue, New York, N. Y.
Welsh Ponies and Cobs	Welsh Pony and Cob Studbook	Welsh Pony and Cob Society of America, John Alexander, secretary, Aurora, Ill.

ASSES.

Jacks and Jennets	American Jack Stock Studbook	American Breeders' Association of Jacks and Jennets, J. W. Jones, secretary, Columbia, Tenn.

SHEEP.

Cheviot	American Cheviot Sheep Flock Book	American Cheviot Sheep Society, F. E. Dawley, secretary, Fayetteville, N. Y.
Cotswold	American Cotswold Record	American Cotswold Registry Association, F. W. Harding, secretary, Waukesha, Wis.
Dorset Horn	Continental Dorset Club Record	The Continental Dorset Club, Joseph E. Wing, secretary, Mechanicsburg, Ohio.
Hampshire Down	Hampshire Down Flock Record	American Hampshire Breeders' Association, Comfort A. Tyler, secretary, Coldwater, Mich.
Leicester	American Leicester Record	American Leicester Breeders' Association, A. J. Temple, secretary, Cameron, Ill.
Lincoln	National Lincoln Sheep Breeders' Record	National Lincoln Sheep Breeders' Association, Bert Smith, secretary, Charlotte, Mich.
Merino (Delaine)	Dickinson Spanish Merino Sheep Register	Dickinson Merino Sheep Record Co., Beulah McDowell, secretary, Canton, Ohio.
Do	National Delaine Merino Register	National Delaine Merino Sheep Breeders' Association, J. B. Johnson, secretary, 248 West Pike street, Canonsburg, Pa.
Merino (French)	American Rambouillet Record	American Rambouillet Sheep Breeders' Association, Dwight Lincoln, secretary, Milford Center, Ohio.
Merino (German)	International Von Homeyer Rambouillet Club Record.	International Von Homeyer Rambouillet Club, E. N. Ball, secretary, Ann Arbor, Mich.
Merino (Spanish)	Register of the Michigan Merino Sheep Breeders' Association.	Michigan Merino Sheep Breeders' Association, E. N. Ball, secretary, Ann Arbor, Mich.
Do	Register of the Vermont, New York, and Ohio Merino Sheep Breeders' Association.	Vermont, New York, and Ohio Merino Sheep Breeders' Association, Wesley Bishop, secretary, R. F. D. No. 1, Delaware, Ohio.
Oxford Down	American Oxford Down Record	American Oxford Down Record Association, W. A. Shafor, secretary, Hamilton, Ohio.
Shropshire	American Shropshire Sheep Record	American Shropshire Registry Association, Mortimer Levering, secretary, Lafayette, Ind.
Southdown	American Southdown Record	American Southdown Breeders' Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Suffolk	American Suffolk Flock Record	American Suffolk Flock Registry Association, James Bowman, secretary, Guelph, Ontario, Canada.

American pedigree record associations and books of record certified by the Secretary of Agriculture—Continued.

HOGS.

Name of breed.	Book of record.	By whom published.
Berkshire	American Berkshire Record	American Berkshire Association, Frank S. Springer, secretary, 510 East Monroe street, Springfield, Ill.
Cheshire	Cheshire Herdbook	Cheshire Swine Breeders' Association, Ed. S. Hill, secretary, Freeville, N. Y.
Chester, Ohio Improved	O. I. C. Record	O. I. C. Swine Breeders' Association, J. C. Hiles, secretary, Cleveland, Ohio.
Duroc-Jersey	American Duroc-Jersey Record	American Duroc-Jersey Swine Breeders' Association, T. B. Pearson, secretary, Thorntown, Ind.
Do	National Duroc-Jersey Record	National Duroc-Jersey Record Association, H. C. Sheldon, secretary, Peoria, Ill.
Hampshire (Thin Rind)	American Hampshire Record	American Hampshire Swine Record Association, E. C. Stone, secretary, Armstrong, Ill.
Poland-China	American Poland-China Record	American Poland-China Record Association, W. M. McFadden, secretary, Union Stock Yards, Chicago, Ill.
Do	National Poland-China Record	National Poland-China Record Company, A. M. Brown, secretary, Drawer 16, Winchester, Ind.
Do	Southwestern Poland-China Record	Southwestern Poland-China Record Association, H. P. Wilson, secretary, Gadsden, Tenn.
Do	Standard Poland-China Record	Standard Poland-China Record Association, George F. Woodworth, secretary, Maryville, Mo.
Tamworth	American Tamworth Swine Record	American Tamworth Swine Record Association, E. N. Ball, secretary, Ann Arbor, Mich.
Yorkshire	American Yorkshire Record	American Yorkshire Club, Harry G. Krum, secretary, Whitebear Lake, Minn.

DOGS.

Fifty-seven recognized breeds	American Kennel Club Studbook	American Kennel Club, A. P. Vredenburgh, secretary, 55 Liberty street, New York, N. Y.

CATS.

Long-haired (Angora or Persian). Short-haired (Siamese, Manx, Mexican, Abyssinian, Indian, Russian, and Japanese).	United States Register and Studbook (except appendix).	United States Official Register Association (Inc.), Mrs. S. Hazen Bond, registrar, 310 First street SE., Washington, D. C.
Long-haired (Persian or Angora). Short-haired (Russian, Siamese, Japanese, Mexican, Manx, Abyssinian, Native).	Studbook of the American Cat Association	American Cat Association, Mrs. Anna L. Besse, secretary-treasurer, 5534 Union avenue, Chicago, Ill.

NATIONAL AND STATE STOCK BREEDERS' ASSOCIATIONS.

Name of organization.	Secretary.	Address.
American Association of Live Stock Herd Book Secretaries.	Charles F. Mills	Springfield, Ill.
American National Live Stock Association	T. W. Tomlinson	Denver, Colo.
American Trotting Association	W. H. Knight	Chicago, Ill.
National Trotting Association	W. H. Gocher	Hartford, Conn.
National Wool Growers' Association	George S. Walker	Cheyenne, Wyo.
The Corn Belt Meat Producers' Association	H. C. Wallace	Des Moines, Iowa.
Alabama Live Stock Association	D. T. Gray [a]	Auburn, Ala.
California Live Stock Breeders' Association	E. W. Major	Berkeley, Cal.
Colorado Cattle and Horse Growers' Association.	F. P. Johnson	P. O. Box 1509, Denver, Colo.
Connecticut Sheep Breeders' Association	Berton C. Patterson	Torrington, Conn.
Southeastern Stock Growers' Association	Z. C. Chambliss	Ocala, Fla.
Georgia Dairy and Live Stock Association	C. L. Willoughby	Experiment, Ga.
Hawaiian Live Stock Breeders' Association	Albert F. Judd	Honolulu, Hawaii.
Idaho Wool Growers' Association	J. C. Clinton, jr	Boise, Idaho.
Illinois Live Stock Breeders' Association	O. H. Swigart	Farmer City, Ill.
Indiana Live Stock Breeders' Association	J. H. Skinner	Lafayette, Ind.
Indiana Swine Breeders' Association	Chas. S. Hemenway	Zionsville, Ind.
Indiana Wool Growers' Association	H. H. Keim	Ladoga, Ind.
Iowa Improved Stock Breeders' Association	W. J. Kennedy	Ames, Iowa.
Iowa Swine Breeders' Association	C. C. Carlin	3403 Fifth street, Des Moines, Iowa.
Interstate Breeders' Association	F. L. Wirick	Sioux City, Iowa.
Kansas Improved Stock Breeders' Association.	H. A. Heath	Topeka, Kans.
Kentucky Beef Cattle Breeders' Association	J. J. Hooper	Lexington, Ky.
Kentucky Live Stock Breeders' Association	Clarence Sale	23 Board of Trade Building, Louisville, Ky.
Kentucky Swine Breeders' Association	M. W. Neal	514 Third st., Louisville, Ky.
Louisiana Stock Breeders' Association	W. H. Dalrymple	Baton Rouge, La.
Eastern Horse Breeders' Association	J. E. Osborne	Calais, Me.
Massachusetts Cattle Owners' Association	J. L. Harrington	Lunenburg, Mass.
Michigan Improved Live Stock Breeders' Association.	A. C. Anderson	Agricultural College, Mich.
Minnesota Horse Breeders' Association	G. W. Patterson	Worthington, Minn.
Minnesota Live Stock Breeders' Association	Andrew Boss	St. Anthony Park, St. Paul, Minn.
Minnesota Sheep Breeders' Association	C. W. Glotfelter	Waterville, Minn.
Minnesota Swine Breeders' Association	D. A. Gaumnitz	St. Anthony Park, St. Paul Minn.
Southern Live Stock Association	J. M. Aldrich	Michigan City, Miss.
Improved Live Stock Breeders' Association	George B. Ellis	Columbia, Mo.
Missouri State Sheep Breeders' Association	M. V. Carroll	Sedalia, Mo.
Central Montana Wool Growers' Association	A. C. Logan	Billings, Mont.
Montana Horse Breeders' Association	R. W. Clark	Bozeman, Mont.
Montana Registered Cattle Feeders' Association.	John W. Pace	Helena, Mont.
Montana Stock Growers' Association	R. H. Wells	Miles City, Mont.
North Montana Roundup Association	T. A. Cummings	Fort Benton, Mont.
Nebraska Improved Live Stock Breeders' Association.	R. H. Searle	Edgar, Nebr.
Nebraska Stock Growers' Association	E. M. Searle, jr	State Capitol, Lincoln, Nebr.
Nebraska State Swine Breeders' Association	W. J. Unitt	Seward, Nebr.
Cattle Growers' Association of New Mexico	W. C. Barnes	Las Vegas, N. Mex.
New Mexico Wool Growers' Association	H. F. Lee	Albuquerque, N. Mex.
Cattle and Horse Protective Association of Central New Mexico.	J. W. Medley	Magdalena, N. Mex.
Northeastern New Mexico Stock Growers' Association.	L. F. Wilson	Folsom, N. Mex.
New York State Sheep Breeders' Association	W. W. Smallwood	Warsaw, N. Y.
New York State Breeders' Association	Albert E. Brown	Batavia, N. Y.
North Dakota Live Stock Association	W. B. Richards	Agricultural College, N. Dak.
Ohio Horse Breeders' Association	Samuel Taylor	Grove City, Ohio.
Ohio Live Stock Association	C. S. Plumb	Columbus, Ohio.
Ohio Swine Breeders' Association	Ernst Freigau	Columbus, Ohio.
Oklahoma Improved Breeders' Association	J. A. Spaulding	Pondcreek, Okla.
Oklahoma Live Stock Association	W. E. Bolton	Woodward, Okla.
Oregon Live Stock Breeders' Association	M. D. Wisdom	Portland, Oreg.
Pennsylvania Live Stock Breeders' Association.	E. S. Bayard	East End, Pittsburg, Pa.
South Carolina Live Stock Association	Lewis A. Klein	Clemson College, S. C.
Missouri River Stockmen's Association	John Hayes	Fort Pierre, S. Dak.
Northwestern Stock Growers' Association	A. W. Sellers	Bellefourche, S. Dak.
South Dakota Improved Live Stock and Poultry Breeders' Association.	James W. Wilson	Brookings, S. Dak.
Western South Dakota Stock Growers' Association.	F. M. Stewart	Buffalogap, S. Dak.
Tennessee Live Stock Breeders' Association	May Overton	42 Arcade, Nashville, Tenn.
Cattle Raisers' Association of Texas	H. E. Crowley	Fort Worth, Tex.
Texas Sheep and Goat Breeders' Association	R. A. Bradford	Taylor, Tex.
Texas Swine Breeders' Association	M. M. Offut	Cleburne, Tex.
Utah Cattle Growers' Association	Wesley K. Walton	Woodruff, Utah.

[a] Acting secretary.

National and State stock breeders' associations—Continued.

Name of organization.	Secretary.	Address.
Utah Cattlemen's Association	J. Wesley Walton	Salt Lake City, Utah.
Mount Pleasant Wool Growers' Association	Fred C. Jensen	Mount Pleasant, Utah.
Utah Wool Growers' Association	Henry Moss	443 Constitution Building, Salt Lake City, Utah.
Inland Stock Breeders' Association	W. A. Linklater	Pullman, Wash.
Washington Live Stock Association	F. M. Rothrock	E. 917 Augusta avenue, Spokane, Wash.
West Virginia Live Stock Association	C. E. Lewis	Savannah, W. Va.
West Virginia Sheep Breeders' Association	J. B. Huyett	Charlestown, W. Va.
Wisconsin Live Stock Breeders' Association	F. H. Scribner	Rosendale, Wis.
Wisconsin Sheep Breeders' Association	William F. Renk	Sun Prairie, Wis.
Snake River Live Stock Association	Harry L. Hays	Dixon, Wyo.
Wyoming Stock Growers' Association	Miss Alice R. Smith	Cheyenne, Wyo.
Wyoming Wool Growers' Association	George S. Walker	1614 Capitol ave., Cheyenne, Wyo.

POULTRY SPECIALTY CLUBS.

Breed.	Club name and secretary's address.
	American Poultry Association, Fred L. Kimmey, secretary-treasurer, Morgan Park, Ill.
CHICKENS.	
Ancona	American Ancona Club, J. Henry Bennett, secretary, Viroqua, Wis.
Blue Andalusian	Blue Andalusian Club of America, E. L. C. Morse, secretary, 9009 Escanaba avenue, Chicago, Ill.
Brahma	American Light Brahma Club, Frank P. Johnson, secretary-treasurer, Station A, Indianapolis, Ind.
Buckeye	National Red Feather Club, Edgar L. Andrews, secretary, Briarcliffe Manor, N. Y.
Buttercup	American Buttercup Club, John Aldrich, secretary-treasurer, Springfield, Mass.
Cochin	American Cochin Club, Arthur R. Sharp, Secretary, Taunton, Mass.
Do	American Buff Cochin Club, C. W. Case, secretary-treasurer, Rochester, Mich.
Cornish	American Cornish Club, H. C. Hayes, secretary-treasurer, Eureka, Ill.
Dominique	National American Dominique Breeders' Club, W. H. Davenport, secretary-treasurer, Colerain, Mass.
Dorking	American Dorking Club, Robert Officer, secretary-treasurer, North Grafton, Mass.
Faverolle	Faverolle Club of America, M. J. Whitty, secretary, 96 East 178th street, New York, N. Y.
Game	National Exhibition Game and Game Bantam Club, E. J. W. Dietz, secretary-treasurer, Downers Grove, Ill.
Hamburg	Hamburg Fanciers' Club, Ralph E. Forbes, secretary, 89 State street, Boston, Mass.
Houdan	American Houdan Club, Daniel P. Shove, secretary-treasurer, Fall River. Mass.
Do	National Houdan Club, E. P. McAvoy, jr., secretary, Cambridge, N. Y.
Do	Western Houdan Club, W. H. Pipfin, secretary-treasurer, Newton, Ill.
Langshan	American Langshan Club, A. H. Asche, secretary, Princeton, Ill.
Do	National Langshan Club, John Aldrich, secretary-treasurer, Springfield, Mass.
Do	National Black Langshan Club of America, P. J. Myers, secretary, Crawfordsville, Ind.
Do	White Langshan Club of America, A. W. Porter, secretary-treasurer, Bridgeport, Ind.
Leghorn	American Leghorn Club, W. W. Babcock, secretary-treasurer, Bath, N. Y.
Do	American Rose Comb Brown Leghorn Club, Fred Alger, secretary-treasurer, Waukau, Wis.
Do	American Single Comb Brown Leghorn Club, E. W. Staebler, secretary-treasurer West Park, Ohio.
Do	American Buff Leghorn Club, George S. Barnes, secretary-treasurer, Battle Creek, Mich.
Do	National Rose Comb White Leghorn Club, John J. Peters, secretary-treasurer, Lincoln, Ill.
Do	National Single Comb White Leghorn Club, F. O. Groesbeek, secretary-treasurer, Hartford, Conn.
Minorca	American Black Minorca Club, George N. Northup, secretary-treasurer, Raceville, N. Y.
Do	American Rose Comb Black Minorca Club, S. T. Campbell, secretary-treasurer, Mansfield, Ohio.
Do	International Rose Comb Black Minorca Club, George H. Northup, secretary-treasurer, Raceville, N. Y.
Orpington	Southwestern Orpington Club, G. A. Livingston, secretary-treasurer, Sherman, Tex.
Do	National Single Comb Black Orpington Club, Milton W. Brown, secretary, Station L, Cincinnati, Ohio.
Do	National Single Comb Buff Orpington Club, Will H. Schadt, secretary, Goshen, Ind.

Poultry specialty clubs—Continued.

Breed.	Club name and secretary's address.
Orpington	American White Orpington Club, Dr. F. E. Bullington, secretary, Box 328, Richmond, Va.
Do	American Orpington Club, Dr. Paul Kyle, Kyle Institute, Flushing, N. Y.
Plymouth Rock	American Plymouth Rock Club, A. C. Smith, secretary-treasurer, Waltham, Mass.
Do	American Buff Plymouth Rock Club, William A. Stolts, secretary-treasurer, R. F. D. No. 19, Indianapolis, Ind.
Do	American Columbian Plymouth Rock Club, E. B. Andrews, secretary-treasurer, 9 West 17th street, New York, N. Y.
Do	Partridge Plymouth Rock Club, William F. Fotterall, secretary-treasurer, Oakford, Pa.
Do	Silver Penciled Rock Club, William F. Fotterall, secretary-treasurer, Oakford, Pa.
Do	White Plymouth Rock Club, Charles H. Ward, secretary-treasurer, R. F. D. No. 24, Bethel, Conn.
Polish	American Polish Club, M. V. Caldwell, secretary-treasurer, R. F. D. No. 5, Lisbon, Ohio.
Rhode Island Red	Rhode Island Red Club of America, George P. Coffin, secretary-treasurer, Freeport, Me.
Do	National Rose Comb Rhode Island Red Club, W. F. Burleigh, secretary-treasurer, Larrabees Point, Vt.
Do	National Single Comb Rhode Island Red Club, J. H. Valliere, secretary-treasurer, Cedar Rapids, Iowa.
Wyandotte	American Black Wyandotte Club, Edwin H. Morris, secretary, Sparkhill, N. Y.
Do	American Buff Wyandotte Club, Henry R. Ingalls, secretary, Greenville, N. Y.
Do	National Columbian Wyandotte Club, George F. Eastman, secretary-treasurer, Granby, Mass.
Do	National Golden Wyandotte Club of America, W. G. Smith, secretary, Bannock, Ohio.
Do	Partridge Wyandotte Club of America, H. R. Hildreth, secretary, Worcester, Mass.
Do	Eastern Silver Wyandotte Club of America, James C. Patterson, secretary, Nyack, N. Y.
Do	Silver Laced Wyandotte Club of America, E. S. Tarbox, secretary-treasurer, Yorkville, Ill.
Do	Silver Penciled Wyandotte Club of America, G. S. Boller, secretary, Little Valley, N. Y.
Do	National White Wyandotte Club, E. S. Hawn, secretary-treasurer, Youngstown Ohio.
Bantam	International Bantam Breeders' Club, Mrs. Azema J. Kimmey, secretary, Morgan Park, Ill.
Do	National Bantam Association, George L. Young, secretary, 349 11th street, Brooklyn, N. Y.
GEESE.	
Toulouse	National Toulouse Goose Club, Mrs. B. F. Hislop, secretary-treasurer, Milford, Ill.
TURKEYS.	
Bronze	National Bronze Turkey Club, E. F. Pullins, secretary-treasurer, R. F. D. No. 1, Rensselaer, Ind.
Waterfowl	Waterfowl Club of America, Edwin H. Morris, secretary-treasurer, Sparkill, N. Y.

LEGAL STANDARDS FOR DAIRY PRODUCTS.

In the table following, prepared in the Dairy Division, are given the standards for dairy products as proclaimed by the Secretary of Agriculture and as established by law in the several States and Territories, so far as obtainable, and revised to February 1, 1909.

The percentages stated represent minimum standards in all cases unless otherwise expressed. States not named are understood to have no laws prescribing standards for dairy products or else leave the subject to local ordinances.

Legal standards for dairy products, 1909.

States.	Milk.			Skim milk.	Cream.	Butter.	Cheese.	Condensed milk.	
	Total solids.	Solids not fat.	Fat.	Total solids.	Fat.	Fat.	Full cream.	Total solids.	Fat.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
United States [a]		8.5	3.25	9.25	18	82.5	[b] 50	28	7
California		8.5	3	9.25	18	80	30	28	7.7
Colorado							35		
Connecticut	11.75	8.5	3.25						
Dist. of Columbia		9	3.5	9.3	20	[c] 83			
Delaware	No standards.								
Florida	Local municipal ordinances.								
Georgia	12	8.5	3.25	9.25	18	8.25	[b] 50	28	7
Hawaii	11.5		2.50						
Idaho	11	8	3	9.25	18	82.5	30	28	7
Illinois			3		15	80	[b] 48		
Indiana		8.5	3.25	9.25	18	82.5	[b] 50	28	7.7
Iowa	12.5		3		15	80			
Kentucky	12	8.5	3.25	9.25	18	82.5	[b] 50	28	7.7
Louisiana	Municipal control.								
Maine	12		3						
Maryland	12.5		3.5					(d)	
Massachusetts	12.15		3.35	9.3	15				
Michigan	12.5 Sp. gr. 29–33		3	Sp. gr. 32	15				
Minnesota	13		3.5		20	80	[b] 45		
Missouri		8.5	3.25	9.25	18	82.5	[b] 50	28	7.7
Montana	12	9	3		15				
Nebraska			3		18				
New Hampshire	13	9.5	3.5	9					
New Jersey	12		3		16				
New Mexico	None.								
New York	12		3					(d)	
North Carolina	12	8.5	3.25		18	82.5	[b] 50	28	7
North Dakota	12		3		15				
Ohio	12		3			80		(d)	
Oklahoma	None.								
Oregon	12.2	9	3.2		20		30	22	4.5
Pennsylvania	12		3	8			32		
Porto Rico	12		3			80	30		
South Carolina	None; municipal control.								
South Dakota	13		3		18	80	[b] 45		
Tennessee	Local control.								
Texas	12.5		3						
Utah	12	8.8	3.2	9	30	80	[b] 50	28	7
Vermont	12.5	9.25	4						
May and June	12								
Virginia		8.5	3.25	9.25	18			26	7.5
Washington		8	3				30		
Wisconsin		8.5	3		18	82.5	[b] 50	28	7
Wyoming	12		2.4			80	20	(d)	
May and June	11.5								

[a] Standard of Purity for Food Products. United States Department of Agriculture, Office of the Secretary, Circular 19.
[b] Per cent of total solids.
[c] Not over 12 per cent water or 5 per cent salt.
[d] Proportion of fat to total solids must be the same as in the crude milk.

Ice cream.—Circular 19 from the Office of the Secretary of Agriculture establishes a standard of 14 per cent milk fat for ice cream; this standard has also been adopted by the States of Missouri, Kentucky, and Indiana. Idaho has a 12 per cent standard, and the city of Memphis, Tenn., by municipal ordinance, an 8 per cent standard.

CONTAGIOUS DISEASES OF ANIMALS IN FOREIGN COUNTRIES.

The status of contagious diseases of domestic animals in a number of foreign countries is shown in the series of tables following. These tables have been compiled from the official reports of the various countries, which are received and placed on file in the library of this department.

The outstanding feature of the general situation during 1908 was the successful outcome of the fight against foot-and-mouth disease in

western Europe. In the previous year's report attention was called to the serious visitation of this disease which occurred in France in the summer of 1906 and overran into Belgium and the Netherlands in the fall of that year. Little headway seemed to be made in combating the outbreak in 1907, but the efforts of the authorities in the three countries named met with better success in 1908, the result being that the disease was wholly eradicated from Belgium and practically so in France and the Netherlands. Details of this as well as other principal features of the animal diseases in the various countries will be found in the résumé below and in the tables which follow.

Austria.—On the whole there was less foot-and-mouth disease than in 1907, although the cases were comparatively numerous in the closing months of 1908.

Belgium.—After an eighteen months' fight the Belgian sanitary authorities succeeded in eradicating foot-and-mouth disease, there having been no cases reported since April, 1908. The situation was also very satisfactory in other respects. Anthrax, blackleg, and rabies prevailed to a moderate extent, but in every instance there were fewer cases reported than in 1907.

France.—Foot-and-mouth disease was reduced to a negligible quantity during the year, there being less than a dozen new outbreaks in the whole country during the last four months. There was little change as regards other animal diseases as compared with 1907, except an increase in swine diseases and a decline in rabies. The latter disease is, however, still quite prevalent, the returns showing an average of upward of 100 cases every month.

Germany.—Foot-and-mouth disease prevailed to a limited extent in the German Empire, and there was less of it at the end of the year than at the beginning.

Great Britain.—The unusual feature of the British report for 1908 was an outbreak of foot-and-mouth disease which occurred in Scotland in February. It was, however, immediately suppressed, only 3 herds and 112 animals having been affected, and no further cases have since been discovered. It will be noticed that prior to this outbreak there had been no foot-and-mouth disease in Great Britain since 1901.

Italy.—Foot-and-mouth disease continues to be the most prevalent stock disease in Italy, sheep scab coming next. Although there were no less than 144,709 cases of the first-named disease during 1908, this was a great improvement over the preceding year, when the number reported was 338,442. Sheep scab was considerably less prevalent than in 1907, although there was a considerable increase in some other diseases.

The Netherlands.—The authorities, like those of Belgium, succeeded in practically eradicating foot-and-mouth disease in May,

since which time only five scattered cases have been reported. The outbreak did not seriously affect the Netherlands until June, 1908, and it reached its culmination in the following August and September. It therefore took just twelve months to subdue the attack.

The monthly and annual status of the animal diseases in the various countries is shown in the following tables:

AUSTRIA.

Number of premises infected with contagious diseases of animals in Austria at monthly periods during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Foot-and-mouth disease	102	10	1	1	3	9
Anthrax	3	7	6	6	20	6
Glanders and farcy	11	9	8	29	41	33
Scab:						
Horses	34	60	67	90	80	54
Sheep	2	1	24	25	43	
Goats		1	23	24	21	25
Blackleg			3	1	5	1
Erysipelas of swine	153	64	27	33	60	208
Hog cholera and swine plague	410	380	347	379	426	490
Blisters upon genitals	6	30	58	156	242	300
Rabies	19	20	47	51	60	36

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Foot-and-mouth disease	103	16	79	412	560	235
Anthrax	108	75	75	20	13	19
Glanders and farcy	32	19	17	7	10	13
Scab:						
Horses	71	69	71	59	38	24
Sheep	7					
Goats	36	32	16	12	10	1
Blackleg	10	4	12	23	9	4
Erysipelas of swine	352	410	413	250	182	73
Hog cholera and swine plague	573	508	380	321	272	271
Blisters upon genitals	186	120	131	117	12	27
Rabies	31	24	31	35	31	25

BELGIUM.

Cases of contagious diseases in Belgium during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Glanders and farcy	1	6	1	9	1	1
Foot-and-mouth disease:						
Cattle	62		59	5		
Swine			3			
Rabies:						
Cases	26	17	7	12	11	3
Suspects	25	8	5	16	11	11
Anthrax	52	52	60	78	53	43
Blackleg	15	11	10	13	13	28

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Glanders and farcy	2	2		2	1		26
Foot-and-mouth disease:							
Cattle							126
Swine							3
Rabies:							
Cases	3	8	7	10	4	5	113
Suspects	14	8	14	4	6	5	127
Anthrax	34	41	52	37	39	35	576
Blackleg	32	39	39	31	22	23	276
Foot rot					1		1
Sheep scab		15					15

DENMARK.

Outbreaks of contagious diseases of animals in Denmark during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	12	15	19	14	12	10
Spinal typhus	1	4	2	6	4	1
Glanders and farcy	6	1			1	5
Malignant catarrhal fever	12	10	7	11	8	13
Erysipelas of swine, acute	12	11	5	4	6	11
Hog cholera, chronic	2		1	1	4	2
Foot rot of sheep	1					

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	11	7	12	11	14	6	143
Spinal typhus	3	2	2	2		4	31
Glanders and farcy	4	2	2				21
Malignant catarrhal fever	18	9	10	3	6	10	117
Erysipelas of swine, acute	48	58	41	55	47	32	330
Hog cholera, chronic		1	1	1			13
Foot rot of sheep							1

FRANCE.

Status of contagious diseases of animals in France during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Foot-and-mouth disease (outbreaks)	195	56	38	19	25	15
Sheep scab (outbreaks)	11	5	10	10	10	12
Sheep pox (outbreaks)	1	1	3	2	4	1
Anthrax (outbreaks)	31	39	40	47	44	38
Blackleg (outbreaks)	38	39	48	37	46	46
Glanders and farcy:						
Number of outbreaks	25	25	23	27	16	38
Horses slaughtered	40	48	25	39	22	60
Rabies (cases)	91	109	110	124	131	112
Erysipelas of swine (outbreaks)	62	58	40	29	38	56
Infectious pneumo-enteritis of swine (outbreaks)	25	38	51	45	44	57

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Foot-and-mouth disease (outbreaks)	42	24	3	4	1	2	424
Sheep scab (outbreaks)	51	5	4	5	9	4	136
Sheep pox (outbreaks)	1	10	7	24	22	23	99
Anthrax (outbreaks)	40	41	46	41	23	27	457
Blackleg (outbreaks)	52	70	88	108	106	93	771
Glanders and farcy:							
Number of outbreaks	30	38	20	22	9	19	292
Horses slaughtered	49	37	21	26	11	20	398
Rabies (cases)	154	127	119	122	125	158	1,482
Erysipelas of swine (outbreaks)	63	75	76	105	99	75	776
Infectious pneumo-enteritis of swine (outbreaks)	45	101	56	35	42	35	574

GERMANY.

Number of localities and farms infected with contagious diseases of animals in Germany at monthly periods during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Glanders and farcy:						
Localities	38	36	34	33	33	21
Farms	46	44	39	37	36	25
Pleuro-pneumonia:						
Localities	3	7	12	12	10	8
Farms	3	7	13	12	10	8
Foot-and-mouth disease:						
Localities	131	116	32	7	8	53
Farms	249	174	50	10	9	139
Swine plague and hog cholera:						
Localities	1,321	1,274	1,382	1,502	1,517	1,387
Farms	1,768	1,663	1,783	1,992	1,976	1,784

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Glanders and farcy:						
Localities	17	35	34	34	36	32
Farms	19	44	44	45	43	40
Pleuro-pneumonia:						
Localities	3	5	9	5	1	2
Farms	3	5	10	5	1	2
Foot-and-mouth disease:						
Localities	51	19	27	46	18	21
Farms	134	76	44	107	60	55
Swine plague and hog cholera:						
Localities	1,315	1,149	1,128	1,196	1,232	1,214
Farms	1,670	1,458	1,500	1,539	1,601	1,607

GREAT BRITAIN.

Annual status of contagious diseases of animals in Great Britain in 1901–1908.

Disease.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Foot-and-mouth disease:								
Outbreaks	12	....	....	....	....	....	....	3
Cases	669	....	....	....	....	....	....	112
Glanders and farcy:								
Outbreaks	1,347	1,155	1,456	1,529	1,214	1,070	850	785
Cases	2,370	2,040	2,499	2,658	2,068	2,012	1,934	2,421
Sheep scab:								
Outbreaks	1,537	1,632	1,792	1,418	918	534	751	849
Cases	22,674	21,523	24,431	....	....	....	....	....
Anthrax:								
Outbreaks	651	678	767	1,049	970	939	1,089	1,108
Cases	971	1,032	1,143	1,589	1,317	1,325	1,466	1,426
Rabies (cases)	1	....	....	....	....	....	....	....
Swine fever:								
Outbreaks	3,140	1,688	1,478	1,196	817	1,280	2,336	2,067
Swine slaughtered (diseased or exposed)	15,237	8,263	7,933	5,603	3,876	7,359	11,275	14,096

HUNGARY.

Number of premises infected with contagious diseases of animals in Hungary at monthly periods during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	116	108	116	133	177	334
Rabies	175	206	228	207	265	350
Glanders and farcy	26	20	24	44	68	72
Foot-and-mouth disease	788	219	28	7	4	16
Sheep pox	196	120	120	118	53	52
Dourine of horses	....	....	....	....	....	....
Blisters upon genitals	14	9	23	140	192	206
Scab:						
Solipeds	76	95	206	584	732	578
Sheep	137	317	380	484	487	858
Barbone of buffalo	4	....	1	1	4	6
Erysipelas of swine	526	250	165	218	348	1,245
Hog cholera	1,937	1,103	856	764	881	2,033

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Anthrax	604	644	473	397	268	168
Rabies	376	380	359	339	338	196
Glanders and farcy	66	68	61	61	55	46
Foot-and-mouth disease	43	26	27	137	440	466
Sheep pox	47	61	68	80	95	101
Dourine of horses	....	....	1	10	90	9
Blisters upon genitals	159	133	118	64	46	31
Scab:						
Solipeds	401	270	218	164	140	80
Sheep	321	209	86	60	85	78
Barbone of buffalo	3	13	43	39	43	37
Erysipelas of swine	2,921	2,618	2,309	1,866	1,347	718
Hog cholera	4,832	6,030	6,295	5,316	4,197	2,725

INDIA (BRITISH).

Number of deaths from contagious diseases of animals during fiscal year 1907-08.

Disease.	United Provinces.	Eastern Bengal and Assam.	Punjab.	Total.
Rinderpest	7,854	32,823	1,735	42,412
Foot-and-mouth disease	828	9,074	732	10,634
Hemorrhagic septicemia	1,799	4,648	7,373	13,820
Anthrax	685	2,932	240	3,857
Blackleg	200	201	632	1,033
Glanders	6	49	2	57
Surra	107	98	90	295
Pleuro-pneumonia	73	....	....	73
Sheep pox	6	....	....	6
Rabies	6	9	25	40

IRELAND.

Annual status of contagious diseases of animals in Ireland, 1901–1908.

Disease.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Anthrax:								
Outbreaks	2	....	4	4	4	4	3	8
Cases	4	....	11	7	4	8	5	11
Glanders and farcy:								
Outbreaks	5	10	5	11	30	8	7	....
Cases	6	43	7	34	107	16	12	....
Rabies:								
Cases	2	....	2	....	....	....	....	....
Sheep scab:								
Outbreaks	545	613	655	486	339	256	333	384
Cases	7,564	7,818	8,306	6,433	4,253	3,513	5,198	6,182
Swine fever:								
Outbreaks	220	166	175	181	137	95	163	159
Cases	1,325	993	1,079	931	1,416	1,103	2,789	3,625
Epizootic lymphangitis:								
Outbreaks	....	....	....	1	10	1	....	....
Cases	....	....	....	1	25	1	....	....
Parasitic mange:								
Outbreaks	174	161	195	162	169	85	77	42
Cases	331	221	295	252	322	130	94	59

NOTE.—In addition to the above the following diseases are scheduled in Ireland, but no cases were reported: Cattle plague, foot-and-mouth disease, pleuro-pneumonia, and sheep pox.

ITALY.

Cases of contagious diseases of animals in Italy during 1908.

Names of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	91	68	101	146	115	349
Blackleg	126	40	16	18	21	29
Foot-and-mouth disease	32,843	18,916	15,832	13,692	20,858	13,956
Glanders and farcy	50	46	110	41	41	45
Sheep scab	1,888	3,666	2,825	1,624	2,482	1,194
Rabies	67	44	46	59	46	46
Infectious disease of swine	949	486	1,173	1,090	1,762	1,207
Contagious mammitis	806	268	....	114	336	299

Names of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	1,009	609	664	334	378	108	3,972
Blackleg	22	17	32	46	24	22	413
Foot-and-mouth disease	13,183	5,479	2,491	3,100	2,049	2,930	144,709
Glanders and farcy	58	37	38	35	22	17	540
Barbone of buffalo	....	10	13	....	....	....	23
Sheep scab	7,017	1,808	174	1,312	129	433	24,552
Rabies	55	42	40	32	37	32	546
Infectious disease of swine	1,586	826	1,492	1,232	1,147	1,017	13,967
Contagious mammitis	2,228	1,007	806	546	3,036	602	10,048

THE NETHERLANDS.

Cases of contagious diseases of animals in the Netherlands during 1908.

Names of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Foot-and-mouth disease	1,170	535	378	104	126	...
Glanders and farcy	2	1	2	3	4	3
Sheep scab	36	16	28	...	83	21
Foot rot of sheep	32	3	6	26	2	33
Anthrax	50	54	66	56	36	19
Erysipelas of swine	9	18	13	5	26	87
Horse mange	...	1	...	117	...	...

Names of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Foot-and-mouth disease	1	...	3	...	...	1	2,318
Glanders and farcy	1	5	2	...	...	3	26
Sheep scab	65	44	195	393	493	297	1,671
Foot rot of sheep	24	26	125	18	20	83	398
Anthrax	23	31	27	28	29	47	466
Erysipelas of swine	251	651	363	61	15	15	1,514
Horse mange	...	...	...	...	...	3	121

NORWAY.

Number of cases of contagious diseases of animals in Norway during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	35	38	35	51	42	34
Blackleg	4	4	3	6	1	7
Braxy of sheep	8	20	6	18	16	7
Malignant catarrh	38	40	43	54	51	64
Hog cholera and swine plague	...	...	...	...	15	...

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	25	23	18	28	47	19	395
Blackleg	6	9	6	11	5	5	67
Braxy of sheep	2	...	...	16	22	10	125
Malignant catarrh	45	36	36	42	32	24	505
Hog cholera and swine plague	...	...	...	3	...	...	18

SWEDEN.

Outbreaks of contagious diseases of animals in Sweden during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Anthrax	17	20	16	30	30	26
Blackleg	...	1	4	2	5	5
Septicemia hemorrhagica of swine	...	2	1	...	...	...
Erysipelas of swine	2	1	2	2	...	2

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Anthrax	19	11	11	8	17	9	214
Blackleg	12	10	1	2	11	3	56
Septicemia hemorrhagica of swine	...	...	...	1	1	...	5
Erysipelas of swine	1	3	6	3	4	...	26

SWITZERLAND.

Cases of contagious diseases of animals in Switzerland during 1908.

Name of disease.	Jan.	Feb.	Mar.	Apr.	May.	June.
Blackleg	8	4	15	42	46	67
Anthrax	35	17	16	29	8	11
Foot-and-mouth disease	251	141	34	130	378	3,776
Glanders and farcy			4			
Erysipelas and hog cholera	279	290	714	681	431	2,186
Sheep scab	3		17	1		
Rabies			1			

Name of disease.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Blackleg	212	158	129	64	16	13	774
Anthrax	20	17	20	13	11	13	210
Foot-and-mouth disease	5,651	1,820	482	450	758	684	14,555
Glanders and farcy		2					6
Erysipelas and hog cholera	2,536	1,225	1,349	1,590	1,112	954	13,347
Sheep scab	11		240			2	274
Rabies						1	2

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C. A. Cary, experiment station veterinarian, Auburn.

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W. Lenton, experiment station veterinarian, Fayetteville.

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Georgia.—Thomas G. Hudson, commissioner of agriculture, Atlanta.

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Idaho.—George E. Noble, State veterinarian, Boise.

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Donald McIntosh, experiment station veterinarian, Urbana.

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R. A. Craig, experiment station veterinarian, Lafayette.

Veterinary medical examiners: George C. Ferling, Richmond; Orville L. Boor, Muncie; John J. Herron, Tipton; A. H. McGlasson, Madison.

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W. H. Dalrymple, experiment station veterinarian, Baton Rouge.

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S. S. Buckley, experiment station veterinarian, College Park.

Massachusetts.—Austin Peters, chief of cattle bureau, State board of agriculture, State House, Boston.

J. B. Paige, experiment station veterinarian, Amherst.

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W. M. Morris, State veterinarian, Cass City.

L. M. Hurt, experiment station veterinarian, East Lansing.

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M. H. Reynolds, experiment station veterinarian, University Farm, St. Paul.

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D. F. Luckey, State veterinarian, Columbia.

J. W. Connaway, experiment station veterinarian, Columbia.

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State board of stock commissioners: W. G. Preuitt, secretary, Helena.

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A. T. Peters, experiment station veterinarian, Lincoln.

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Sheep sanitary board (having charge also of goats): Harry F. Lee, secretary, Albuquerque; Solomon Luna, Los Lunas; H. W. Kelly, Las Vegas; Charles Sleter, Clayton; A. D. Garrett, Roswell, and J. W. Akers, Santa Fe.

New York.—R. A. Pearson, commissioner of agriculture, Albany. J. F. DeVine, chief veterinarian, Albany.

North Carolina.—W. A. Graham, commissioner of agriculture, Raleigh. W. G. Chrisman, State veterinarian, Raleigh. W. J. Hartman, assistant veterinarian, Raleigh.

G. A. Roberts, experiment station veterinarian, West Raleigh.

North Dakota.—State live-stock sanitary board: W. L. Richards, secretary, Dickinson; W. F. Crewe, veterinarian and executive officer, Devils Lake; Andrew Veitch, Grand Forks; E. J. Walsh, Willow City; J. W. Robinson, Cold Harbor.

L. Van Es, experiment station veterinarian, Agricultural College.

Ohio.—Paul Fischer, State veterinarian, Columbus.

A. P. Sandles, secretary State live-stock commission, Columbus.

Oklahoma.—G. T. Bryan, superintendent live-stock inspection, Guthrie; J. K. Callicotte and W. B. McAlester, veterinarians to State board of agriculture, Guthrie.

A. J. Emery, chief dairy inspector, Guthrie.

L. L. Lewis, experiment station veterinarian.

Oregon.—W. H. Lytle, State veterinarian and sheep inspector, Pendleton.

Pennsylvania.—State live-stock sanitary board: Governor Edwin S. Stuart, president; Leonard Pearson, secretary and State veterinarian; Louis A. Klein, deputy State veterinarian, all at Harrisburg.

Porto Rico.—Thomas A. Allen, veterinary inspector, health office, San Juan.

Rhode Island.—State board of agriculture: John J. Dunn, secretary, Providence; John S. Pollard, veterinarian, Providence.

South Carolina.—M. Ray Powers, State veterinarian, Clemson College; R. O. Feeley, assistant veterinarian, Clemson College.

South Dakota.—State live-stock sanitary board: Thomas H. Hicks, chairman and State veterinarian, Milbank; C. L. Eakin, secretary, Blunt; J. N. Long, Wanbay; P. H. O'Neil, Faulkton; F. R. Cock, Bellefourche; Frank Stewart, Buffalo Gap; W. W. Davis, Mount Vernon.

E. L. Moore, experiment station veterinarian, Brookings.

Tennessee.—John Thompson, commissioner of agriculture, Nashville.

J. H. McDowell, State live-stock commissioner, Nashville.

Moses Jacob, experiment station veterinarian, Knoxville.

Texas.—State live-stock sanitary commission: R. H. Harris, chairman, San Angelo; A. S. Gage, San Antonio; T. F. McClure, Stamford.

E. L. Forbes, State veterinarian, Fort Worth.

M. Francis, experiment station veterinarian, College Station.

Utah.—A. Carrington Young, State veterinarian, Salt Lake City.

State board of sheep commissioners: L. R. Anderson, chairman, Manti; Arthur A. Callister, secretary, Salt Lake City; Thomas W. Jones, Salt Lake City; J. S. Ostler, Nephi.

H. J. Frederick, experiment station veterinarian, Logan.

T. B. Beatty, secretary State board of health, Salt Lake City.

Vermont.—H. S. Willson, State cattle commissioner, Arlington.

Virginia.—J. G. Ferneyhough, State veterinarian, Burkeville.

State board of veterinary examiners: H. S. Willis, Rapidan; Thomas Fraser, Richmond; S. C. Neff, Staunton; H. Bannister, Roanoke.

Washington.—S. B. Nelson, State veterinarian and experiment station veterinarian, Pullman.

West Virginia.—J. B. Garvin, secretary State board of agriculture, Charleston. Consulting veterinarians: W. C. Atkeson, Buffalo; J. C. Callander, Parkersburg; L. N. Reefer, Wheeling; W. M. Stanley, Charleston.

Wisconsin.—State live-stock sanitary board: Herbert Lothe, secretary, Madison; D. B. Clark, State veterinarian, Madison; M. P. Ravenel, bacteriologist, Madison; George McKerrow, Pewaukee; George Wylie, Morrisonville; Grant U. Fisher, Janesville.

A. S. Alexander, experiment station veterinarian, Madison.

Wyoming.—William F. Pfaeging, State veterinarian, Cheyenne.

State board of live-stock commissioners: George R. Eyken, Laramie; Fred G. S. Hesse, Buffalo; Addison A. Spaugh, Manville; Thomas Durbin, secretary, Cheyenne.

State board of sheep commissioners: William Daley, president, Rawlins; W. D. McKeon, Newcastle; J. M. Wilson, Douglas; George S. Walker, secretary-treasurer, Cheyenne.

O. L. Prien, experiment station veterinarian, Laramie.

PUBLICATIONS OF THE BUREAU IN 1908.

Following is a list of publications issued by the Bureau of Animal Industry during the year 1908, excepting regulations, which are to be found in the appendix to this report. A circular giving a list of the available publications of the Bureau and indicating how they may be obtained will be sent free upon request.

Publications in the following list for which no price is indicated will be sent free of charge to persons in the United States, so long as the editions permit, on application to the Secretary of Agriculture, Washington, D. C.

Applications for publications to which a price is affixed should be made to the Superintendent of Documents, Government Printing Office, Washington, D. C., the officer designated by law to sell Government publications. All payments should be made to him and not to the Department of Agriculture, and should be sent by postal money order, express order, or New York draft. Currency may be sent at the sender's risk, but postage stamps, foreign money, and uncertified checks will not be accepted. No charge is made for postage on documents forwarded to points in the United States, Guam, Hawaii, the Philippine Islands, or Porto Rico, or to Canada, Cuba, or Mexico. To other countries the regular rate of postage is charged, and remittances must cover such postage. To residents of foreign countries the price of 6 cents a copy, including postage, has been fixed for publications for which no price is indicated in the list.

REPORTS.

Twenty-third Annual Report of the Bureau of Animal Industry. By A. D. Melvin, Chief of Bureau. Pp. 478, pls. 24, figs. 35. Price, 60 cents.

Report of the Chief of the Bureau of Animal Industry for [the fiscal year ended June 30] 1908. Pp. 68.

BULLETINS.

Bulletin 39. Index-Catalogue of Medical and Veterinary Zoology. By Ch. Wardell Stiles, Consulting Zoologist, and Albert Hassall, Assistant in Zoology. Part 20. Authors: N to Nyström. Pp. 1493–1574. Price, 15 cents.

Same, Part 21. Authors: O to Ozzard. Pp. 1575–1624. Price, 10 cents.

Bulletin 101. The Available Energy of Red Clover Hay. (Investigations with the respiration calorimeter in cooperation with the Pennsylvania State College Agricultural Experiment Station.) By Henry Prentiss Armsby and J. August Fries. Pp. 61, diagrams 4. Price, 10 cents.

Bulletin 102. Further Experiments Concerning the Production of Immunity from Hog Cholera. By M. Dorset, C. N. McBryde, and W. B. Niles, of the Biochemic Division. Pp. 96. Price, 15 cents.

Bulletin 103. Experiments in Beef Production in Alabama. By J. F. Duggar, Director Alabama Agricultural Experiment Station, and W. F. Ward, Scientific Assistant. Pp. 28, pls. 11. Price, 10 cents.

Bulletin 104. Medical Milk Commissions and the Production of Certified Milk in the United States. By Clarence B. Lane, Assistant Chief of the Dairy Division. Pp. 43, pls. 6, figs. 11. Price, 10 cents.

Bulletin 105. Varieties of Cheese: Descriptions and Analyses. By C. F. Doane, Assistant Dairyman, Dairy Division, and H. W. Lawson, Office of Experiment Stations, Department of Agriculture. Pp. 72. Price, 10 cents.

Bulletin 106. Experiments on the Digestibility of Prickly Pear by Cattle. By R. F. Hare, Professor of Chemistry in the College of Agriculture and Mechanic Arts of the Territory of New Mexico. Pp. 38, pl. 1, fig. 1. Price 10 cents.

Bulletin 107. The Analysis of Coal-Tar Creosote and Cresylic Acid Sheep Dips. By Robert M. Chapin, Assistant Chemist, Biochemic Division. Pp. 35, fig. 1. Price 10 cents.

Bulletin 108. Feeding for Meat Production. By Henry Prentiss Armsby, Director, Institute of Animal Nutrition, The Pennsylvania State College; Expert in Animal Nutrition, Bureau of Animal Industry. Pp. 89, fig. 1. Price 10 cents.

Bulletin 109. Proteolytic Changes in the Ripening of Camembert Cheese. By Arthur W. Dox, Chemist in Cheese Investigations, Dairy Division. Pp. 24. Price 5 cents.

CIRCULARS.

Circular 23 (third revision). Direcciones Para el Uso de la Vacuna Contra la Morrina Negra (Directions for the Use of Blackleg Vaccine). (Spanish edition.) By Victor A. Nörgaard; translation by Manuel Fraile. Pp. 9, figs. 3.

Circular 97 (revised). How to Get Rid of Cattle Ticks. By R. P. Steddom, Chief of the Pathological Division. Pp. 4, fig. 1.

Circular 113 (revised). Classification for American Carriage Horses. By George M. Rommel, Animal Husbandman. Pp. 4.

Circular 120. Some Observations on Rabies. By E. C. Schroeder, Superintendent of Experiment Station. Pp. 16. (Reprint from the Twenty-third Annual Report of the Bureau of Animal Industry.)

Circular 121. Osteoporosis or Bighead of the Horse. By John R. Mohler, Chief of the Pathological Division. Pp. 8, figs. 5. (Reprint from the Twenty-third Annual Report of the Bureau of Animal Industry.)

Circular 122. Epizootic Cerebro-Spinal Meningitis of Horses. By R. W. Hickman, Chief of the Quarantine Division. Pp. 8. (Reprint from the Twenty-third Annual Report of the Bureau of Animal Industry.)

Circular 124. Suggestions for Horse and Mule Raising in the South. By George M. Rommel, Animal Husbandman. Pp. 15. (Reprint from the Twenty-third Annual Report of the Bureau of Animal Industry.)

Circular 125. The Federal Meat Inspection Service. By A. D. Melvin, Chief of the Bureau of Animal Industry. Pp. 40, pls. 15, fig. 1. (Reprint from the Twenty-third Annual Report of the Bureau of Animal Industry.)

Circular 126. A Simple Method of Keeping Creamery Records. By B. D. White, Assistant Dairyman in Charge of Creamery Investigations, Dairy Division. Pp. 12.

Circular 127. Tubercle Bacilli in Butter: Their Occurrence, Vitality, and Significance. By E. C. Schroeder, Superintendent of Experiment Station, and W. E. Cotton, Expert Assistant at Experiment Station. Pp. 23.

Circular 128. White Diarrhea of Chicks. With Notes on Coccidiosis in Birds. By George Byron Morse, Assistant in Bacteriology and Pathology, Pathological Division. Pp. 7.

Circular 129. Rabies and Its Increasing Prevalence. By George H. Hart, Assistant in Pathology and Bacteriology, Pathological Division. Pp. 26, fig. 1.

Circular 130. Paraffining Butter Tubs. By L. A. Rogers, Bacteriological Chemist, Dairy Division. Pp. 6, fig. 1.

Circular 131. Designs for Dairy Buildings. By Ed. H. Webster, Chief of the Dairy Division. Pp. 26, figs. 35. (Reprint from the Twenty-third Annual Report of the Bureau of Animal Industry.)

Circular 132. A Practical Method for the Detection of Beef Fat in Lard. By James A. Emery, Assistant Chief of the Biochemic Division. Pp. 9.

Circular 133. Report and Recommendations Regarding Veterinary Colleges in the United States. Pp. 13.

Circular 134. Classified List of Available Publications of the Bureau of Animal Industry. Pp. 8.

Circular 135. Officials, Organizations, and Educational Institutions Connected with the Dairy Interests (1908). By Ed. H. Webster, Chief of the Dairy Division. Pp. 31.

Circular 137. The Preservation of Our Native Types of Horses. By George M. Rommel, Animal Husbandman. Pp. 63, pl. 1, figs. 19. (Reprint from the Twenty-fourth Annual Report of the Bureau of Animal Industry.)

Circular 141. Foot-and-Mouth Disease. By D. E. Salmon and Theobald Smith; Revised by John R. Mohler. Pp. 8. (Reprint from Special Report on Diseases of Cattle.)

SEPARATES FROM TWENTY-THIRD ANNUAL REPORT.

The Danish Hog Industry. By Andrew Fossum, of the Editorial Office. Pp. 28.

The Susceptibility of Tubercle Bacilli to Modification. By John R. Mohler and Henry J. Washburn, of the Pathological Division. Pp. 55, pls. 4.

Investigations in Animal Nutrition. By Henry Prentiss Armsby, Director Pennsylvania State College Institute of Animal Nutrition; Expert in Animal Nutrition, Bureau of Animal Industry. Pp. 23, pls. 3, figs. 2.

FARMERS' BULLETINS.

Farmers' Bulletin 137. The Angora Goat. By George Fayette Thompson; revised by Edward L. Shaw, Assistant in Animal Husbandry in Charge of Sheep and Goat Investigations, Bureau of Animal Industry. Pp. 48, figs. 8.

Farmers' Bulletin 205 (revised). Pig Management. By George M. Rommel, Animal Husbandman, Bureau of Animal Industry. Pp. 45, figs. 22.

Farmers' Bulletin 345. Some Common Disinfectants. By M. Dorset, Chief of the Biochemic Division, Bureau of Animal Industry. Pp. 12.

APPENDIX.

RULES AND REGULATIONS OF THE SECRETARY OF AGRICULTURE RELATING TO THE ANIMAL INDUSTRY ISSUED IN 1908.

AMENDMENT 2 TO B. A. I. ORDER 129.

Regulations Concerning the Importation of Hay and Straw from Continental Europe—Importation of Hay and Straw from Belgium.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., December 2, 1908.

Amendment 1 to B. A. I. Order 129, of July 21, 1905, regulating the importation into the United States of hay and straw, is hereby canceled. The importation into the United States, on and after this date, of hay and straw from Belgium will be governed by the terms of B. A. I. Order 129 of October 4, 1904.

JAMES WILSON, *Secretary.*

AMENDMENT 2 TO B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Amendment to Paragraph (e), Section 2, of B. A. I. Order 136.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., June 11, 1908.

It is hereby ordered that the last sentence of paragraph (*e*), section 2, of Bureau of Animal Industry Order 136, dated June 20, 1906, be amended to read as follows:

"Registration contrary to the provisions of this paragraph of imported animals not registered or eligible to registration in books of record included in section 6 of this order, or in one of the amendments to this order, to obtain the duty-free privilege for such animals, will render an association registering such animals liable to withdrawal of certification."

JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 3 to B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Amendment to Paragraph 1, Section 7, of B. A. I. Order 136.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 12, 1908.

It is hereby ordered that the first paragraph of section 7 of Bureau of Animal Industry Order 136, dated June 20, 1906, be amended by the addition of the following sentence:

"However, associations, companies, and clubs in the following list shall accept no imported animals for registration in order to obtain free entry, unless such animals are eligible to such registration under the rules of entry prescribed for American-bred animals."

W. M. HAYS, *Acting Secretary.*

AMENDMENT 4 to B. A. I. ORDER 136.

Regulations for the Certification of Associations of Breeders of Purebred Live Stock and Books of Record of Pedigrees—Withdrawal of Certification.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., November 17, 1908.

On account of failure to comply with the provisions of B. A. I. Order 136, the certification of the following association and book of record of pedigrees has been withdrawn and the Secretary of the Treasury informed to this effect:

American Books of Record.

HOGS.

Name of breed.	Book of record.	By whom published.
Hampshire (Thin Rind).	American Hampshire Record.	American Hampshire Swine Record Association, E. C. Stone, secretary, Armstrong, Ill.

JAMES WILSON, *Secretary.*

AMENDMENT 3 TO B. A. I. ORDER 142.

Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States—Amendment to Regulation 41, Providing for the Quarantine of Sheep Imported from Canada for Breeding Purposes.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., June 4, 1908.

Regulation 41 of the Regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, B. A. I. Order 142, is hereby amended to read as follows:

Regulation 41.—All sheep imported into the United States from Canada for breeding, grazing, or feeding must be inspected at the port of entry by an inspector of the Bureau of Animal Industry. They also must have been inspected by a Canadian official veterinarian and be accompanied by a certificate signed by him, stating that he has inspected the sheep and has found them free from disease, and that no contagious disease affecting sheep has existed in the district in which the animals have been kept for six months preceding the date of importation. The owner or importer shall present an affidavit that said certificate refers to the sheep in question: *Provided, however,* That sheep which upon inspection by an inspector of the Bureau of Animal Industry do not show signs of scabies or other disease may be imported from a district infected with scab if such sheep are accompanied by a certificate signed by a Canadian official veterinarian, stating that they have been twice carefully dipped under his personal supervision, or under the personal supervision of another Canadian official veterinarian, in one of the dips approved by the Secretary of Agriculture, as described in Regulation 33 of B. A. I. Order 143: *Provided further,* That all sheep for breeding purposes shall be subjected to a quarantine of thirty days.

This amendment shall become and be effective on and after June 15, 1908.

JAMES WILSON, *Secretary of Agriculture.*

Regulation 33 of B. A. I. Order 143, as amended, which is referred to in the foregoing amendment, reads as follows:

Regulation 33.—The dips now approved are:

(*a*) The tobacco-and-sulphur dip, made with sufficient extract of tobacco or nicotine solution to give a mixture containing not less than five one-hundredths of 1 per cent of nicotine and 2 per cent flowers of sulphur: *Provided,* That for the first dipping of infected sheep, in lieu of the sulphur prescribed, a sufficient additional amount of extract of tobacco or nicotine solution shall be used to give a mixture containing not less than seven one-hundredths of 1 per cent of nicotine.

(*b*) The lime-and-sulphur dip, made by mixing 8 pounds of unslaked lime and 24 pounds of flowers of sulphur and boiling with 30 gallons of water for not less than two hours. All sediment should be allowed to subside before the liquid is placed in the dipping vat. This liquid should be diluted sufficiently to make 100 gallons before use.

And pending further investigation, the following-described dips:

(*c*) The cresol dip, which consists of a mixture of cresylic acid[a] with soap. When diluted ready for use this dip should contain one-half of 1 per cent of cresylic acid.

(*d*) The coal-tar creosote dip, which is made by mixing coal-tar creosote or coal-tar oils and cresylic acid separately with resin soap in varying proportions. This dip should contain when diluted ready for use not less than 1 per cent by weight of coal-tar oils and cresylic acid. In no case should the diluted dip contain more than four-tenths of 1 per cent nor less than one-tenth of 1 per cent of cresylic acid; but when the proportion of cresylic acid falls below two-tenths of 1 per cent the coal-tar oils should be increased sufficiently to bring the total of the tar oils and the cresylic acid in the diluted dip up to 1.2 per cent by weight.

The cresol dip and the coal-tar creosote dip should always be tested on a small scale with the water and under the conditions to be employed in dipping, in order to avoid possible injury to stock. The diluted sample should be allowed to stand for at least an hour. If after this length of time there is a separation of an oily layer, the dip should not be used with that kind of water. Especial care in this connection is necessary where hard water is to be used.

In the undiluted coal-tar creosote dips there may be, in cold weather especially, a separation of naphthalene and other constituents of the dip. Care should therefore be taken to see that the concentrated dip is homogeneous in character before using any portion of it.

Manufacturers who desire the Department to approve their dips for official dipping should submit a sample of their product to the Bureau of Animal Industry in Washington and accompany this with the formula used in preparing the dip.

Before a proprietary substance is approved for use in official dipping the manufacturer must agree as follows:

(1) To recommend for sheep scab a dilution of the product, so as to conform to the requirements of the Department of Agriculture.

(2) To maintain said product at a uniform composition.

(3) To place on packages of dips which have been examined and found to conform to the requirements of the Department the following statement:

"A sample of this product has been submitted to the United States Department of Agriculture for examination. We guarantee the contents of this package to be of the same composition as the sample submitted to the Department, and that when diluted according to the directions printed thereon for the treatment of sheep scab, it will give a dipping fluid of the composition required of a ____________[b] dip by the regulations of the Secretary of Agriculture governing sheep scab."

(4) To have on containers or advertising matter no reference to the United States Government or any of its Departments except as provided in the preceding paragraph, unless such reference has been submitted to and approved by the Department of Agriculture, and to have on containers or advertising matter no false or misleading statement.

AMENDMENT 4 TO B. A. I. ORDER 142.

Regulations for the Inspection and Quarantine of Horses, Cattle, Sheep, and Other Ruminants, and Swine Imported into the United States—Amendment to Regulation 1, Designating Lowelltown, Me. (Port of Bangor), as a Quarantine Station for the Months of September, October, and November, 1908.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., August 15, 1908.

Regulation 1 of the Regulations of the Secretary of Agriculture for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States (B. A. I. Order No. 142) is hereby amended to include Lowelltown, Me. (port of Bangor, Me.), as an animal quarantine station during the months of September, October, and November, 1908, for the inspection and quarantine of animals imported into the United States.

This order to terminate November 30, 1908.

W. M. HAYS, *Acting Secretary of Agriculture.*

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[a] By the term cresylic acid as used in these regulations is meant cresols and other phenols derived from coal tar, none of which boils below 185° C. nor above 250° C.

[b] There should be inserted here the name of the *class* of dips to which the product belongs, such as "cresol" or "lime and sulphur," etc.

AMENDMENT 3 TO B. A. I. ORDER 143.

Regulations of the Secretary of Agriculture Governing the Inspection, Disinfection, Certification, Treatment, Handling, and Method and Manner of Delivery and Shipment of Live Stock Which is the Subject of Interstate Commerce—Modifying Regulations 11 to 18, Inclusive, Relating to the Prevention of the Spread of Splenetic Fever of Cattle, and Revoking Amendment No. 2 to B. A. I. Order No. 143 (Effective on and after April 1, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The regulations of the Secretary of Agriculture governing the inspection, disinfection, certification, treatment, handling, and method and manner of delivery and shipment of live stock which is the subject of interstate commerce, issued under date of March 22, 1907, effective on and after April 15, 1907, are hereby modified by the revocation of regulations 11 to 18, inclusive, and the substitution therefor of the following regulations, which revocation shall take effect on April 1, 1908, on and after which date the regulations given below shall become and be effective until otherwise ordered.

REGULATIONS TO PREVENT THE SPREAD OF SPLENETIC FEVER OF CATTLE.

Regulation 11.—Whenever any State or Territory located within an area quarantined by the Secretary of Agriculture for splenetic, southern, or Texas fever shall duly establish a State or Territorial quarantined area different from the quarantined area established by the Secretary of Agriculture, and shall obtain the legislation requisite to enforce said State or Territorial quarantine strictly and completely within the boundaries of said State or Territory, the Secretary of Agriculture will, if the said State or Territorial quarantine be satisfactory, adopt by a rule said State or Territorial quarantine, and the State or Territorial quarantine thus adopted shall define the limits of that portion of the Federal quarantined area.

Regulation 12.—Whenever any State or Territory under authority of law shall establish a State or Territorial quarantine for splenetic fever which differs from the quarantine established by the Secretary of Agriculture for the said disease, and shall desire a modification of the area quarantined by the Secretary of Agriculture, the proper officer of the said State or Territory shall forward to the Secretary of Agriculture a true map or description of such State or Territorial quarantine and a duly authenticated copy of the laws and regulations relating to the establishment and enforcement of the quarantine.

Regulation 13.—Cattle of the quarantined area of any State or Territory shall not at any time be transported, driven, or allowed to drift therefrom to any portion of the quarantined area of any other State or Territory to which the intrastate movement of cattle of the quarantined area is prohibited by the State or Territorial authorities thereof.

Regulation 14.—Interstate shipments of cattle from the quarantined area may be made at any time, by rail or boat, to recognized slaughtering centers for immediate slaughter, but cattle shall not be trailed or driven or hauled in private conveyances from the quarantined area in any State or Territory to any point in any other State or Territory not included in the quarantined area.

Interstate shipments of cattle from the quarantined area may be made during the months of January, November, and December of each year by rail or boat for any purpose into the District of Columbia, the States of Colorado, Connecticut, Delaware, Idaho, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming, and that portion of the State of Missouri north of the Missouri River, under such restrictions as may be imposed by officials of the State or Territory or the District of Columbia at destination.

When cattle are transported under the provisions of this regulation, the following rules regarding their movement shall be observed:

(*a*) Cattle of the quarantined area when received at destinations outside the quarantined area, or which in course of interstate transportation from the quarantined area are unloaded at a point not within the quarantined area to be fed or watered or for other purposes, shall be handled over platforms, chutes, and alleyways, and placed in yards or portions of yards reserved for cattle of the quarantined area. Such yards or portions of yards, alleyways, chutes, and platforms shall be constructed and maintained in accordance with the specifications set out below.

SPECIFICATIONS FOR QUARANTINE YARDS AND APPROACHES.

(1) The outside fences inclosing such yards or portions of yards and the fences on either side of the alleyways, chutes, and platforms leading thereto, shall be tight board fences not less than 6 feet high on the inside.

(2) If such yards or portions of yards, alleyways, chutes, and platforms are adjacent to yards or portions of yards, alleyways, chutes, and platforms for cattle not of the quarantined area, there shall be between them a space not less than 10 feet wide, which shall be inaccessible to cattle; this space shall be limited on one side by the 6-foot fence required by specification 1 and on the other side by a tight board fence not less than 5 feet high.

(3) If such yards or portions of yards, alleyways, chutes, and platforms are either isolated from or adjacent to other yards, portions of yards, alleyways, chutes, or platforms, there shall be built and maintained on all sides thereof to which cattle of the vicinity might otherwise have access a cattle-proof fence not less than 5 feet high and not less than 15 feet from the 6-foot fence required by specification 1.

(4) The only means of egress from yards and portions of yards for cattle of the quarantined area in transit shall be by way of the alleyways, chutes, and platforms inclosed by 6-foot fences, as required by specification 1, to cars for reforwarding, and under no circumstances shall there exist any connection between such yards or portions of yards and the yards or portions of yards for cattle not of the quarantined area, or other adjacent premises.

(5) The yards or portions of yards reserved for cattle of the quarantined area shall be so located, or such drainage facilities shall be provided therefor, that water therefrom will not flow onto the adjacent property.

(6) The yards or portions of yards reserved for cattle of the quarantined area shall be marked by a conspicuous sign bearing the words "QUARANTINE YARDS" or "QUARANTINE PENS" in letters not less than 10 inches in height.

(*b*) If cattle not of the quarantined area be driven over platforms, chutes, or alleyways, or placed in the yards or portions of yards reserved for cattle of the quarantined area, such cattle shall thereafter be treated in all respects as if they were actually of the quarantined area.

(*c*) The cars or boats which have carried cattle of the quarantined area shall be cleaned and disinfected as hereinafter provided as soon as possible after unloading and before the said cars or boats are again used in the interstate transportation of live stock or merchandise.

(*d*) If for any reason, such as delays or wrecks, it is necessary to unload cattle of the quarantined area which are being transported as "Southern Cattle" into pens or yards which have not been specially provided for that purpose, as hereinbefore indicated, the transportation company shall immediately forward notice of such unloading and the reasons therefor to the Chief of the Bureau of Animal Industry at Washington, D. C., and the premises shall be disinfected as hereinafter provided.

(*e*) The proper officers of the transportation companies shall securely affix to both sides of all cars carrying interstate shipments of cattle from the quarantined area, except as hereinafter provided, durable placards not less than 5½ by 8 inches in size, on which shall be printed with permanent black ink and in bold-face letters not less than 1½ inches in height, the words "SOUTHERN CATTLE." These placards shall also show the name of the place from which the shipment was made, the date of the shipment (which must correspond with the date of the waybills and other papers), the name of the transportation company, and the name of the place of destination. Each of the waybills, conductors' manifests, memoranda, and bills of lading pertaining to such shipments by cars or boats shall have the words "SOUTHERN CATTLE" plainly written or stamped upon its face. Whenever such shipments are transferred to another transportation company or into other cars or boats, or are rebilled or reconsigned from any point not in the quarantined area to a point other than the original destination, the cars into which said cattle are transferred and the new waybills, conductors' manifests. memoranda, and bills of lading covering said shipments by cars or boats shall be marked as herein specified for cars, carrying said cattle from the quarantined area, and for the billing, etc., covering the same. If for any reason the placards required by this regulation are removed from the car or are destroyed or rendered illegible they shall be immediately replaced by the transportation company or its agents, the intention being that legible placards shall be maintained on the car from the time such shipments leave the quarantined area until they arrive at final destination.

(*f*) No car or boat containing an interstate shipment of cattle of the quarantined area shall receive on board cattle which are not of the quarantined area. Interstate shipments of cattle of the quarantined area shall not be made to points outside of said quarantined area where proper facilities have not been provided for transferring the

said cattle from the cars or landing to the stock yards and slaughterhouses without passing them over public highways, unless permission for such passing is first had and obtained from the proper authorities at point of destination.

(*g*) The cars and boats used for the interstate transportation of cattle of the quarantined area, and also the chutes, alleyways, and pens not reserved for the exclusive use of such cattle used in transit and at points of destination, shall be disinfected in the following manner: Remove all litter and manure. This litter and manure may be disinfected by mixing it with lime or saturating it with a 5 per cent solution of pure carbolic acid; or, if not disinfected, it shall be stored where no cattle can come in contact with it during the period from February 1 to October 31, inclusive, of each year. Wash the cars and the watering and feeding troughs with water until clean. Saturate the entire surface of the cars, including the inner surface of the car doors, and the fencing, troughs, chutes, and floors of the pens with a mixture made of 1½ pounds of lime and one-fourth pound of pure carbolic acid to each gallon of water, or with any coal-tar creosote dip permitted in the official dipping of sheep for scabies, provided the same is used at one-fifth the maximum dilution (5 times the minimum strength) specified for dipping sheep.

(*h*) Cars which have carried cattle within the quarantined area of any State or Territory shall be cleaned and disinfected before being taken to any point in another State or Territory not in the quarantined area. This provision shall not apply to cars containing cattle in the course of interstate transportation for immediate slaughter, in accordance with these regulations.

(*i*) The regulations relating to the movement of cattle of the quarantined area as prescribed by the proper State officers at destination shall be carefully observed.

Regulation 15.—(*a*) Cattle not of the quarantined area which are transported interstate by rail through the quarantined area may be unloaded therein for rest, feed, and water into properly equipped noninfectious pens, provided such pens and the platforms, chutes, and alleyways leading thereto are constructed and maintained in accordance with the specifications set out below.

SPECIFICATIONS FOR NONINFECTIOUS PREMISES.

(1) The outside fences inclosing such pens, and the fences on either side of the alleyways, chutes, and platforms leading thereto shall be tight board fences not less than 6 feet high on the inside.

(2) If such pens, alleyways, chutes, and platforms are adjacent to pens, alleyways, chutes, and platforms for cattle of the quarantined area, there shall be between them a space not less than 10 feet wide, which shall be inaccessible to cattle; this space shall be limited on one side by the 6-foot fence required by specification 1, and on the other side by a tight board fence not less than 5 feet high.

(3) If such pens, alleyways, chutes, and platforms are either isolated from or adjacent to other pens, alleyways, chutes, or platforms there shall be built and maintained on all sides thereof, to which cattle of the vicinity might otherwise have access, a cattle-proof fence not less than 5 feet high and not less than 15 feet from the 6-foot fence required by specification 1.

(4) The only means of egress from such pens shall be by way of the alleyways, chutes, and platforms inclosed by 6-foot fences as required by specification 1 to cars for reforwarding, and under no circumstances shall there exist any connection between such pens and the pens for cattle of the quarantined area, or other adjacent premises.

(5) Such noninfectious premises shall be so located, or such drainage facilities shall be provided therefor, that water from the surrounding area will not flow onto or through them.

(6) Such pens shall be marked by a conspicuous sign bearing the words "NONINFECTIOUS PENS" in letters not less than 10 inches in height.

(*b*) Cattle infested with the *Margaropus annulatus*, or southern cattle tick, disseminate the contagion of splenetic, southern, or Texas fever; therefore cattle not of the quarantined area which are infested with the *Margaropus annulatus* ticks shall be considered as infected cattle and shall be subject to the regulations governing the interstate movement of cattle of the quarantined area.

Regulation 16.—Stock-yard companies receiving interstate shipments of cattle infested with the said ticks shall place the said cattle in the pens set aside for the use of cattle of the quarantined area, and transportation companies are required to clean and disinfect, in accordance with the requirements of these regulations, all cars and boats used in interstate transportation which have contained the infected cattle.

Regulation 17.—Cattle of the quarantined area, or other cattle infested with ticks, which have been properly dipped in Beaumont crude petroleum, or otherwise treated in a manner approved by the Secretary of Agriculture, under the supervision of an inspector of the Bureau of Animal Industry, and which have been examined and certified to be free of infection by the said inspector, may be shipped interstate at any time, subject

only to such restrictions as may be imposed by State, Territorial, or District officers at points of destination: *Provided*, That when cattle are to be dipped, as specified herein, they shall, within six hours immediately prior to dipping, be given an opportunity to drink sufficient water to quench their thirst. Shipments of cattle that have been dipped or treated as herein provided shall be forwarded in clean, disinfected cars, shall be accompanied by certificates of dipping or treatment issued by the inspector supervising the same, and shall not be driven through the quarantined area or be unloaded therein, except at such points as may be designated in the rules of the Secretary of Agriculture.

The interstate movement of horses and mules infested with ticks (*Margaropus annulatus*) may be made only in accordance with the regulations and rule governing the interstate movement of tick-infested cattle.

Regulation 18.—Before accepting or moving an interstate shipment of cattle to a point not in the quarantined area from that portion of the quarantined area from which under the rules of the Secretary of Agriculture cattle may be shipped after inspection for purposes other than immediate slaughter, transportation companies shall secure a signed statement from each owner or consignor of said cattle, showing the purpose for which the cattle are shipped. In every case this statement shall accompany the waybills.

Amendment No. 2 to B. A. I. Order No. 143 is hereby revoked, to take effect upon April 1, 1908.

Done at Washington this seventeenth day of March, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. L. ORDER 145.

Amendment 1 to Rule 2, Revision 1.—To Prevent the Spread of Scabies in Cattle (Amendment effective on and after March 1, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious disease known as scabies is not now known to exist, or exists to a slight extent only, among cattle in the counties of Norton, Phillips, Graham, and Rooks, in the State of Kansas, quarantined by Rule 2, Revision 1, dated March 22, 1907, and effective April 15, 1907.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority of law, do hereby amend said Rule 2, Revision 1, to prevent the spread of scabies in cattle, in the following particulars, to wit:

That part of said rule which limits the quarantined portion of the State of Kansas is amended to read as follows: That part of the State of Kansas lying west of the western boundaries of the counties of Norton, Graham, Russell, Barton, Stafford, Pratt, and Barber and south of the southern boundaries of the counties of Graham and Rooks.

The effect of this order is to release from quarantine on account of scabies in cattle the counties of Norton, Phillips, Graham, and Rooks.

Done at Washington this eleventh day of February, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 2 TO B. A. I. ORDER 145.

Amendment 2 to Rule 2, Revision 1.—To Prevent the Spread of Scabies in Cattle (Amendment Effective on and after May 1, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious disease known as scabies is not now known to exist, or exists to a slight extent only, among cattle in certain counties of the State of Nebraska, quarantined by Rule 2, Revision 1, dated March 22, 1907, and effective April 15, 1907.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority of law, do hereby amend said Rule 2, Revision 1, to prevent the spread of scabies in cattle, in the following particulars, to wit:

That part of said rule which quarantines the State of Nebraska is amended to read as follows:

"That part of the State of Nebraska lying west and north of the following-described line is quarantined: Beginning on the State line at the northwest corner of Knox County; thence south along the western boundaries of Knox, Antelope, and Boone counties to the northeast corner of Greeley County; thence west along the northern boundaries of Greeley and Valley counties to the northwest corner of Valley County; thence southerly along the western boundaries of Valley and Sherman counties to the southwest corner of Sherman County; thence west and south along the northern and western boundaries of Buffalo County to the southwest corner thereof; thence west along the northern boundaries of Phelps, Gosper, and Frontier counties to the northwest corner of Frontier County; thence south along the western boundaries of Frontier and Redwillow counties to the southwest corner of Redwillow County at the State line."

The effect of this order is to release from quarantine on account of scabies in cattle the counties of Knox, Cedar, Dixon, Dakota, Thurston, Wayne, Pierce, Antelope, Boone, Madison, Stanton, Cuming, Burt, Washington, Dodge, Colfax, Platte, Greeley, Valley, Sherman, Howard, Nance, Merrick, Polk, Butler, Saunders, Douglas, Sarpy, Cass, Otoe, Lancaster, Seward, York, Hamilton, Hall, Buffalo, Frontier, Gosper, Phelps, Kearney, Adams, Clay, Fillmore, Saline, Gage, Johnson, Nemaha, Richardson, Pawnee, Jefferson, Thayer, Nuckolls, Webster, Franklin, Harlan, Furnas, and Redwillow.

Done at Washington this first day of April, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 2 TO B. A. I. ORDER 146.

Amendment 2 to Rule 3, Revision 1.—To Prevent the Spread of Scabies in Sheep (Amendment Effective on and after September 15, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious and communicable disease known as scabies is not now known to exist, or exists to a slight extent only, among sheep in the States of Kansas and Nebraska, that portion of North Dakota lying north and east of the Missouri River, and that portion of South Dakota lying east of the Missouri River, the entire area of which States is now quarantined by Rule 3, Revision 1, dated March 22, 1907, and effective April 15, 1907.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, do hereby remove and revoke the quarantine placed by Rule 3, Revision 1, upon the following area, to wit:

The States of Kansas and Nebraska, that portion of North Dakota lying north and east of the Missouri River, and that portion of South Dakota lying east of the Missouri River.

Done at Washington this second day of September, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 147.

Amendment to Regulations Prescribed in Regard to Renovated Butter in Accordance with the Act of Congress Approved May 9, 1902; Amending Regulation 15 in Regard to Labeling Renovated Butter (Effective on and after October 1, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 30, 1908.

The following regulation, amending and superseding Regulation 15 of Bureau of Animal Industry Order 147, dated July 11, 1907, and Internal Revenue Regulations 9, Revised July, 1907, has been issued jointly by the Secretary of the Treasury and the Secretary of Agriculture, effective on and after October 1, 1908.

W. M. HAYS,
Acting Secretary of Agriculture.

Regulation 15.—Whenever any manufacturer's package of renovated butter is empty it shall be the duty of the person who removes the contents thereof to destroy utterly the tax-paid stamp on such empty package. Any person having in his possession empty renovated butter packages the tax-paid stamps on which have not been destroyed will be liable to a heavy penalty.

Original packages of renovated butter for export only may be covered with cloth, jute, or burlap, provided that there be stenciled on the covering of the package, in black letters on a white background, the words "RENOVATED BUTTER" in one or two lines, in full-faced gothic letters not less than 1 inch square. The words "FOR EXPORT ONLY" must appear in one line 1 inch below the words "RENOVATED BUTTER," in full-faced gothic letters not less than three-eighths of an inch square. These markings are to be the only markings on one side or surface of the package.

Where possible, inspection will be made before the outer covering is put on the packages. If, however, inspection be necessary after the outer coverings have been placed on the packages, the exporter or his agent will be required to remove the outer covering from any or all packages designated by the inspector.

Nothing in this regulation shall be deemed to change or dispense with the requirement of Regulation 25 hereof in any way.

Approved:

L. A. COOLIDGE,
Acting Secretary of the Treasury.

W. M. HAYS,
Acting Secretary of Agriculture.

WASHINGTON, D. C., *September 14, 1908.*

B. A. I. ORDER 150.

Regulations Governing the Meat Inspection of the United States Department of Agriculture.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., April 1, 1908.

For the purpose of preventing the use in interstate or foreign commerce of meat and meat food products which are unsound, unhealthful, unwholesome, or otherwise unfit for human food, under the authority conferred upon the Secretary of Agriculture by the provisions of the act of Congress approved June 30, 1906 (34 Stat., 674), the following regulations are hereby prescribed for the inspection, reinspection, examination, supervision, disposition, and method and manner of handling live cattle, sheep, swine, and goats, and the carcasses and meat food products of cattle, sheep, swine, and goats, for the sanitation of the establishments at which inspection is maintained, and for the transportation of meat and meat food products from one State or Territory or the District of Columbia to any other State or Territory or the District of Columbia or to any place under the jurisdiction of the United States or to any foreign country.

These regulations, which for purposes of identification are designated as B. A. I. Order 150, supersede B. A. I. Order 137, dated July 25, 1906, and all amendments thereto, and shall become and be effective at once.

JAMES WILSON, *Secretary of Agriculture.*

REGULATION 1. SCOPE OF INSPECTION.

SECTION 1. All slaughtering, packing, meat canning, salting, rendering, or similar establishments, except as hereinafter provided, the meat or meat food products of which, in whole or in part, enter into interstate or foreign commerce, shall have inspection under these regulations. The Secretary of Agriculture may exempt from inspection establishments operated by farmers, retail butchers, or retail dealers supplying their customers, but in the absence of such exemption inspection is required.

SECTION 2. Branch houses of official establishments, when such branch houses are engaged in interstate or foreign commerce and slaughter animals or process meat, shall be considered a part of the parent house, and products received into such branch houses or sent from them shall be subject to these regulations, and inspection shall be maintained therein.

REGULATION 2. ORGANIZATION OF FORCE.

SECTION 1. *Paragraph 1.* All permanent employees of the Department of Agriculture engaged in the work of meat inspection are appointed upon certification of the Civil Service Commission that they have passed the examination prescribed by that Commission. Promotions in all classes are made on the basis of efficiency, deportment, and length of service. Such employees include:

Paragraph 2. Inspectors in charge.—These are inspectors assigned by the Bureau of Animal Industry to supervise official work at each official station. Such employees

report directly to the Chief of the Bureau of Animal Industry and are chosen by reason of their fitness for responsibility as determined by their records in the service. At stations where slaughtering is conducted, only veterinary inspectors are placed in charge.

Paragraph 3. Veterinary inspectors.—All applicants examined for these positions must be graduates of recognized veterinary colleges having a course of not less than three years leading to the degree. All final ante-mortem and post-mortem examinations are conducted by veterinarians. At some stations the veterinarians are assisted in making preliminary examinations by trained laymen known as inspectors' assistants.

Paragraph 4. Traveling veterinary inspectors.—To observe the conditions of sanitation of the establishments at the various stations, note the processes of ante-mortem and post-mortem inspection, confer with and instruct inspectors regarding it, with a view to a uniform system throughout the country, and to report these matters to the Washington office, constitute the principal duties of these employees.

Paragraph 5. Laboratory inspectors.—These employees possess technical training in microscopical and chemical examination of meat food products, and their inspections are conducted in laboratories located at various slaughtering centers. Pathological laboratories are also maintained, to which diseased specimens may be sent when necessary for diagnosis.

Paragraph 6. Meat inspectors.—These employees are laymen, experienced in the curing, canning, packing, or otherwise preparing of meat; they supervise that work and the use of permitted preservatives described in Regulation 22.

Paragraph 7. Traveling meat inspectors.—These employees perform a service similar to that required of traveling veterinary inspectors, but along the line of the preparation and handling of meat products.

Paragraph 8. Inspectors' assistants.—These employees are laymen, who are first assigned to routine duties and are promoted through examination to higher duties, such as assisting in conducting ante-mortem and post-mortem examinations.

Paragraph 9. Patrolmen.—Patrolmen are employed to patrol the establishments at night, to oversee the receipts and shipments of meat, and to observe any operations conducted at night. They consist of veterinarians, inspectors' assistants, or meat inspectors, according to the character of the work where assigned.

Paragraph 10. Skilled laborers.—These employees supervise the marking of meat and meat containers, and perform similar work. They are eligible for promotion only through examination.

REGULATION 3. INTERPRETATION AND DEFINITION OF WORDS AND TERMS.

Wherever in these regulations the following words, names, or terms are used they shall be construed as follows:

SECTION 1. *Official establishment.*—This term shall mean any slaughtering, meat-canning, salting, rendering, or similar establishment at which inspection is mantained under the meat-inspection law approved June 30, 1906 (34 Stat., 674).

SECTION 2. *Inspectors and Department employees.*—These terms shall mean, respectively, inspectors and employees of the Bureau of Animal Industry.

SECTION 3. *"Inspected and Passed."*—This phrase, or any authorized abbreviation thereof, shall mean that the carcasses, parts of carcasses, meat, and meat food products so marked have been inspected and passed for food under these regulations.

SECTION 4. *Rendered into lard or tallow.*—This phrase shall mean that the carcasses, parts of carcasses, meat, and meat food products so designated are allowed to be made into edible lard or edible tallow.

SECTION 5. *"U. S. Inspected and Condemned."*—This phrase shall mean that the carcasses, parts of carcasses, meat, and meat food products so marked are unfit for food and shall be destroyed for food purposes.

SECTION 6. *Carcass.*—This word shall apply to the carcass of an animal that has been killed under these regulations and shall include all parts which are to be used for food.

SECTION 7. *Primal parts of carcasses.*—This phrase shall mean the usual sections or cuts of the dressed carcass commonly known in the trade, such as sides, quarters, shoulders, hams, backs, bellies, etc., and beef tongues, beef livers, and beef tails, before they have been cut, shredded, or otherwise subdivided preliminary to use in the manufacture of meat food products.

SECTION 8. *Meat food products.—Paragraph 1.* A meat food product, within the meaning of the meat-inspection act and of these regulations, is considered to be any article of food intended for human use which is derived or prepared in whole or in part from any edible portion of the carcass of cattle, sheep, swine, or goats, if the said edible portion so used is a considerable and definite portion of the finished food.

Paragraph 2. Mixture.—A mixture of which meat is an ingredient will not be considered a meat food product unless the meat contained therein is a definite and consider-

able portion of the said mixture. But where such mixture is prepared in a part of an official establishment, the sanitation of that part of the establishment will be supervised by the Department, and the meat or meat food product will be inspected before it enters the said mixture. The mixture shall not bear the meat-inspection legend or any simulation thereof. If any reference is made to Federal inspection it shall be in the following form: "The meat contained herein has been inspected and passed at an establishment where Federal inspection is maintained." Mixtures such as mince-meat, soups, etc., which come under this description and which are not officially labeled, are allowed in interstate and foreign commerce without further inspection, and without certificates, subject to the provisions and requirements of the Food and Drugs Act of June 30, 1906, and the regulations made thereunder.

SECTION 9. *Medical meat products.*—Products such as meat juice, meat extract, etc., which are intended only for medicinal purposes and are advertised only to the medical profession, are not considered meat food products within the meaning of this order.

SECTION 10. *Vinegar.*—The word vinegar, as used herein, shall mean cider vinegar, wine vinegar, malt vinegar, sugar vinegar, glucose vinegar, or spirit vinegar.

REGULATION 4. INSPECTION OR EXEMPTION.

SECTION 1. The proprietor or operator of each slaughtering, packing, meat-canning, rendering, or similar establishment engaged in the slaughtering of cattle, sheep, swine, or goats, or in the packing, canning, or other preparation of any meat food product for interstate or foreign commerce, shall make application to the Secretary of Agriculture for inspection or for exemption from inspection, except in cases where inspection or exemption is already in effect. In case of change of ownership or change of location of an establishment already having inspection, a new application shall be made. Exemption under the law can be given only to establishments operated by retail butchers and retail dealers. Such application shall be in writing addressed to the Secretary of Agriculture, Washington, D. C., shall state the location of the establishment, and shall be made on blanks which will be furnished by the Chief of the Bureau of Animal Industry upon request.

SECTION 2. Inspection shall not be begun if an establishment is not in a sanitary condition, nor unless the establishment provides and guarantees to maintain adequate facilities for conducting such inspection.

SECTION 3. If in the judgment of the Secretary of Agriculture the retail butcher or retail dealer who is operating an establishment and engaged in supplying his customers through the medium of interstate or foreign commerce is entitled to exemption from Federal inspection, a numbered certificate of exemption will be furnished to the applicant for use with transportation companies and other companies and persons in securing the movement of his products. If an establishment, including both market and slaughterhouse of such retail butcher or dealer, is not in a sanitary condition a certificate of exemption will not be issued.

SECTION 4. Exempted establishments shall be open to the inspectors of the Bureau of Animal Industry, shall be maintained in a clean condition, and shall conform to the same regulations as govern official establishments in regard to labeling, dyes, chemicals, and preservatives, and unsound, unwholesome, and unfit meat.

REGULATION 5. OFFICIAL NUMBER.

SECTION 1. *Paragraph 1.* When inspection is established the Secretary of Agriculture will give the establishment a number, and this number shall be used to mark the meat and meat food products of the establishment as hereafter prescribed.

Paragraph 2. Two or more official establishments under the same ownership or control may use the same establishment number, provided a serial letter is added in each case to designate the establishment and to enable its product to be identified.

Paragraph 3. Persons, firms, or corporations owning subsidiary companies having legal entity may use the names of such companies, provided application has been made for inspection and it has been granted, the inspection legend in such case to bear the official establishment number of the parent firm or corporation.

Paragraph 4. Each official establishment must be separate and distinct from any other establishment or department in which animal products are handled at which inspection is not maintained. When two or more companies prepare their products in the same official establishment they must obtain inspection under the same number. The name of the distributer may appear upon the label.

REGULATION 6. ASSIGNMENT OF INSPECTORS, ETC.

SECTION 1. The Chief of the Bureau of Animal Industry will designate an inspector to take charge of the inspection at each official establishment, and will assign to said inspector such assistants as may be necessary.

SECTION 2. For the purpose of enforcing the law and regulations all employees of the Bureau of Animal Industry shall have access at all times, by day or night, whether the establishment be operated or not, to every part of the establishment.

SECTION 3. Each employee of the Bureau of Animal Industry working under these regulations will be furnished with a numbered badge, which he shall wear over the left breast on the outer clothing while in the performance of his official duties, and which shall not be allowed to leave his possession. This official badge shall be sufficient identification to entitle him to admittance at all regular entrances and to all parts of the establishment and premises.

SECTION 4. Office room, including light and heat, shall be provided by proprietors of establishments, rent free, for the exclusive use, for official purposes, of the inspector and other employees of the Department assigned thereto. The room or rooms set apart for this purpose must be properly ventilated, conveniently located, and provided with lockers suitable for the protection and storage of such supplies as may be required; all to meet the approval of the inspector in charge.

REGULATION 7. ALL CARCASSES AND PRODUCTS INSPECTED.

SECTION 1. All cattle, sheep, swine, or goats slaughtered at an official establishment, and all meat and meat food products prepared therein, shall be inspected, handled, prepared, and marked as required by these regulations.

REGULATION 8. NOTICE OF DAILY OPERATIONS, ETC.

SECTION 1. The manager of each official establishment shall inform the inspector in charge, or his assistant, when work has been concluded for the day, and of the day and hour when work will be resumed. Under no circumstances shall any department of an establishment be operated except under the supervision of an employee of the Bureau of Animal Industry. All slaughtering of animals and the preparation of meat and meat food products shall be done within reasonable hours, and with reasonable speed, the facilities of the establishment being considered.

SECTION 2. Where one inspector is detailed to conduct the work at two or more small establishments where few animals are slaughtered or where but a small quantity of meat or meat food products is prepared, the inspector in charge may designate the hours for work.

SECTION 3. No work shall be performed at official establishments during any day on which such work is prohibited by the law of the State or Territory in which the establishment is located. However, the Department will require that it be judicially determined that such work is prohibited by the State law.

REGULATION 9. BRIBERY.

SECTION 1. It is a felony, punishable by fine and imprisonment, for any person, firm, or corporation to give, pay, or offer, directly or indirectly, to any Department employee authorized to perform any duty under these regulations any money or other thing of value with intent to influence said employee in the discharge of his duty under these regulations. It is also a felony, punishable by fine and imprisonment, for any Department employee engaged in the performance of duty under these regulations to receive or accept from any person, firm, or corporation engaged in interstate or foreign commerce any gift, money, or other thing of value given with any purpose or intent whatsoever.

REGULATION 10. SANITATION.

SECTION 1. After the receipt of an application for inspection or exemption an examination of the establishment and premises will be made and the requirements for sanitation and the necessary facilities for inspection will be specified.

SECTION 2. Plans and specifications, in duplicate, of plants for which application for inspection is made, also of new plants and plants to be remodeled, should be submitted to the Secretary of Agriculture.

SECTION 3. Official establishments and establishments to which certificates of exemption have been issued shall be suitably lighted and ventilated and maintained in a sanitary condition, and shall be provided with efficient drainage, having properly trapped or other approved sewer connections. Rooms in which inspection is carried on shall, by heating or other means, be kept reasonably free from steam and other vapors, in order that proper inspection can be made. All work in such establishments shall be performed in a cleanly and sanitary manner.

SECTION 4. Ceilings, walls, pillars, partitions, etc., shall be kept in a sanitary condition, and when necessary they shall be washed, scraped, painted, or otherwise treated as required. Where floors or other parts of a building, or tables or other parts of the equipment, are so old or in such poor condition that they can not be readily made sani-

tary they shall be removed and replaced by suitable materials. All floors upon which meats are piled during the process of curing shall be so constructed that they can be kept in a clean and sanitary condition, and all meat piled upon floors shall be suitably protected from trucks, etc. Walks and platforms or approaches leading into establishments shall be kept clean to prevent tracking dirt into the same.

SECTION 5. All trucks, trays, and other receptacles, all chutes, platforms, racks, tables, etc., and all knives, saws, cleavers, and other tools, and all utensils, machinery, and vehicles used in moving, handling, cutting, chopping, mixing, canning, or other processes shall be thoroughly cleaned before using.

SECTION 6. Managers of establishments must require employees to be cleanly. The aprons, smocks, or other outer clothing worn by employees who handle meat or meat food products shall be of a material that is readily cleansed and made sanitary, and only clean garments shall be worn. Persons who handle meat or meat food products shall be required to keep their hands clean, and they shall be required also to pay particular attention to the cleanliness of their boots or shoes.

SECTION 7. Persons affected with tuberculosis or any other communicable disease shall not be employed in any of the departments of establishments where carcasses are dressed, meat is handled, or meat food products are prepared; and any employee of such establishment who may be suspected of being so affected shall be reported by the inspector in charge to the manager of the establishment and to the Chief of the Bureau of Animal Industry.

SECTION 8. All water-closets, toilet rooms, and dressing rooms shall be entirely separated from compartments in which carcasses are dressed or meat or meat food products are cured, stored, packed, handled, or prepared. Where such rooms open into compartments in which meat or meat food products are handled they must, when this is considered necessary, be provided with properly ventilated vestibules and with automatically closing doors. They shall be conveniently located, sufficient in number, ample in size, and fitted with modern lavatory accommodations, including toilet paper, soap, running hot and cold water, towels, etc. They shall be properly lighted, suitably ventilated, and kept in a sanitary condition. Convenient and sanitary urinals shall be provided; and washstands, near at hand, shall also be provided.

SECTION 9. The rooms or compartments in which meat or meat food products are prepared, cured, stored, packed, or otherwise handled shall be free from odors from toilet rooms, catch basins, casing departments, tank rooms, hide cellars, etc., and shall be kept free from flies and other vermin by screening, or other methods. All rooms or compartments shall be provided with cuspidors of such shape as not readily to be upset and of such material and construction as to be readily disinfected, and employees who expectorate shall be required to use them.

SECTION 10. The feeding of hogs or other animals on the refuse of slaughterhouses shall not be permitted on the premises of an exempted establishment or an official establishment, and no use incompatible with proper sanitation shall be made of any part of the premises on which such establishment is located. All yards, fences, pens, chutes, alleys, etc., belonging to the premises of such establishments, whether they are used or not, shall be maintained in a sanitary condition, and no nuisance shall be allowed in the establishment or on its premises.

SECTION 11. Butchers who dress or handle diseased carcasses or parts shall cleanse their hands of all grease and then immerse them in a prescribed disinfectant and rinse them in clear water before dressing or handling healthy carcasses. All butchers' implements used in dressing diseased carcasses shall be sterilized either in boiling water or by immersion in a prescribed disinfectant, followed by rinsing in clear water. Facilities for such cleansing and disinfection, approved by the inspector in charge, shall be provided by the establishment. Separate sanitary trucks, etc., which shall be appropriately and distinctly marked, shall be furnished for handling diseased carcasses and parts. Following the slaughter of any animal affected with an infectious disease, a stop shall be made until the implements have been cleansed and disinfected, unless other clean implements are provided.

SECTION 12. Inspectors are required to furnish their own implements for use in dissecting, incising, or examining diseased carcasses or unsound parts, and are required to use the same means for disinfecting implements, hands, etc., that are prescribed for employees of the establishment.

SECTION 13. Due care must be taken to prevent meat and meat food products from falling on the floor; and in the event of their having so fallen, they must be condemned or the soiled portions removed and condemned. When meat or meat food products are being emptied into tanks, some device, such as a metal funnel, must be used.

SECTION 14. Carcasses shall not be inflated with air from the mouth and no inflation of carcasses except by mechanical means shall be allowed. Carcasses shall not be dressed

with skewers, knives, etc., that have been held in the mouth. Skewers shall be cleaned before being used again. Spitting on whetstones or steels when sharpening knives shall not be allowed.

SECTION 15. Only good, clean, and wholesome water and ice shall be used in the preparation of carcasses, parts, meat, or meat food products. Whenever there is any doubt regarding the sanitary condition of the water supply, notice shall be sent immediately to the Chief of the Bureau of Animal Industry.

SECTION 16. Wagons or cars in which meat or meat food products are transported shall be kept in a clean and sanitary condition. The wagons used in transporting loose meat between official establishments shall be so closed and covered that the contents shall be kept clean, and so constructed that they may, when necessary, be locked and sealed with Government seals, which seals shall be affixed and broken only by employees of the Department.

SECTION 17. Skins and hides from animals condemned for tuberculosis or any other disease infectious to man, but showing no outward appearance of disease, may be removed (except as provided in Regulation 13, section 2) for tanning or other uses in the arts when disinfected as follows: Each skin and hide must be immersed for not less than five minutes in a 5 per cent solution of liquor cresolis compositus, or a 5 per cent solution of carbolic acid, or a 1 to 1,000 solution of bichlorid of mercury. The process of skinning and dipping must be conducted entirely in the retaining room, or other specially prepared place, approved by the inspector in charge, for final inspection.

REGULATION 11. ANTE-MORTEM EXAMINATION AND INSPECTION.

SECTION 1. An ante-mortem examination and inspection shall be made of all cattle, sheep, swine, and goats about to be slaughtered before they shall be allowed to be killed in an official establishment. Satisfactory facilities for conducting said inspection and for separating and holding apart from passed animals those marked "U. S. Suspect" shall be provided.

SECTION 2. All animals showing symptoms or suspected of being affected with any disease or condition which, under these regulations, would probably cause their condemnation in whole or in part when slaughtered shall be marked by affixing to the animal a metal tag bearing the words "U. S. Suspect." All such animals, except as hereinafter provided, shall be set apart and slaughtered separately from other animals at an official establishment.

SECTION 3. Animals which have been tagged for pregnancy or for having recently given birth to young, and which have not been exposed to any infectious or contagious disease, and vaccine animals with unhealed lesions accompanied by fever and which have not been exposed to any other infectious or contagious disease, are not required to be slaughtered, but before any such animal is removed the tag shall be detached by a Department employee and returned with his report to the inspector in charge.

SECTION 4. If any pathological condition is suspected in which the question of temperature is important, such as Texas fever, anthrax, pneumonia, blackleg, or septicemia, the exact temperature should be taken. Due consideration, however, must be given to the fact that extremely high temperature may be found in otherwise normal hogs when subjected to exercise or excitement, and a similar condition may obtain to a less degree among other classes of animals.

SECTION 5. Animals commonly termed "downers," or crippled animals, shall be tagged before slaughter as provided for in Regulation 17, section 1, for the purpose of identification at the time of slaughter, and shall be passed upon in accordance with these regulations.

REGULATION 12. POST-MORTEM INSPECTION AT TIME OF SLAUGHTER.

SECTION 1. A careful inspection shall be made of all animals at the time of slaughter. The head, tongue, tail, thymus gland, and all viscera, and all parts and blood used in the preparation of meat food or medical products, shall be retained in such manner as to preserve their identity until after post-mortem examination has been completed, in order that they may be identified in case of condemnation of the carcass. Suitable racks or metal receptacles shall be provided for retaining such parts.

SECTION 2. Carcasses and parts thereof found to be sound, healthful, wholesome, and fit for human food shall be passed and marked as provided in these regulations.

SECTION 3. Should any lesion of disease or other condition that would render the meat or any organ unfit for food purposes be found on post-mortem examination, the carcass, part, or organ shall be marked immediately with a tag, as provided in Regulation 17, section 3. Carcasses which have been so marked shall not be washed or trimmed unless such washing or trimming is authorized by the inspector.

REGULATION 13. DISPOSAL OF DISEASED CARCASSES AND ORGANS.

SECTION 1. The carcasses or parts of carcasses of all animals slaughtered at an official establishment and found at time of slaughter or at any subsequent inspection to be affected with any of the diseases or conditions named below shall be disposed of according to the section of this regulation pertaining to the disease or condition. It is to be understood, however, that owing to the fact that it is impracticable to formulate rules covering every case, and to designate at just what stage a process becomes loathsome or a disease noxious, the decision as to the disposal of all carcasses, parts, or organs not specifically covered by these regulations shall be left to the veterinary inspector in charge.

SECTION 2. All carcasses showing lesions of anthrax or charbon, regardless of the extent of the disease, and including the hide, hoofs, horns, viscera, fat, blood, and all other portions of the animal, shall be condemned and immediately incinerated. The killing bed upon which the animal was slaughtered shall be disinfected with a 10 per cent solution of formalin, and all knives, saws, cleavers, and other instruments which have come in contact with the carcass shall be treated as provided in Regulation 10, section 11, before being used upon another carcass.

SECTION 3. Carcasses of animals showing lesions of blackleg shall be condemned.

SECTION 4. Carcasses of animals affected with hemorrhagic septicemia shall be condemned.

SECTION 5. Carcasses showing lesions of pyemia or septicemia shall be condemned.

SECTION 6. Carcasses of vaccine animals mentioned under Regulation 11, section 3, shall be condemned.

SECTION 7. Carcasses of animals which showed symptoms of rabies before slaughter shall be condemned.

SECTION 8. Carcasses of animals which showed symptoms of tetanus before slaughter shall be condemned.

SECTION 9. Carcasses of animals affected with malignant epizootic catarrh and showing generalized inflammation of the mucous membranes shall be condemned.

SECTION 10. *Paragraph 1.* Carcasses showing well-marked and progressive lesions of hog cholera or swine plague in more than two of the organs (skin, kidneys, bones, or lymphatic glands) shall be condemned.

Paragraph 2. Provided they are well nourished, carcasses showing slight and limited lesions of these diseases may be passed.

Paragraph 3. Carcasses which reveal lesions more numerous or advanced than those for carcasses to be passed, but not so severe as the lesions described for carcasses to be condemned, may be rendered into lard, provided they are cooked by steam for four hours at a temperature not lower than 220 degrees Fahrenheit, or at a pressure of 4 pounds.

Paragraph 4. In inspecting carcasses showing lesions of hog cholera or swine plague in the skin, bones, kidneys, or lymphatic glands, due consideration shall be given to the extent and severity of the lesions found in the viscera.

SECTION 11. *Paragraph 1.* If a carcass affected with actinomycosis or lumpy jaw is in a well-nourished condition and there is no evidence upon post-mortem examination that the disease has extended from a primary area of infection in the head, the carcass may be passed, but the head, including the tongue, shall be condemned.

Paragraph 2. Carcasses of animals showing uncomplicated localized actinomycotic lesions other than, or in addition to, those specified in paragraph 1 of this section may be passed after the infected organs and parts have been removed and condemned.

Paragraph 3. Carcasses of animals showing a generalized actinomycosis shall be condemned.

SECTION 12. When the lesions of caseous lymphadenitis are limited to the superficial lymphatic glands or to a few nodules in an organ, involving also the adjacent lymphatic glands, and the carcass is well nourished, the meat may be passed after the affected parts are removed and condemned. If extensive lesions, with or without pleuritic adhesions, are found in the lungs, or if several of the visceral organs contain caseous nodules and the carcass is emaciated, it shall be condemned.

SECTION 13. *Paragraph 1.* The following principles are declared for guidance in passing on carcasses affected with tuberculosis:

Principle A.—The fundamental thought is that meat should not be used for food if it contains tubercle bacilli, if there is a reasonable possibility that it may contain tubercle bacilli, or if it is impregnated with toxic substances of tuberculosis or associated septic infections.

Principle B.—On the other hand, if the lesions are localized and not numerous; if there is no evidence of distribution of tubercle bacilli through the blood, or by other means, to the muscles or to parts that may be eaten with the muscles; and if the animal is well nourished and in good condition, there is no proof, or even reason to suspect, that the flesh is unwholesome.

Principle C.—Evidences of generalized tuberculosis are to be sought in such distribution and number of tuberculous lesions as can be explained only upon the supposition of the entrance of tubercle bacilli in considerable number into the systemic circulation. Significant of such generalization are the presence of numerous uniformly distributed tubercles throughout both lungs; also tubercles in the spleen, kidneys, bones, joints, and sexual glands, and in the lymphatic glands connected with these organs and parts, or in the splenic, renal, prescapular, popliteal, and inguinal glands, when several of these organs and parts are coincidentally affected.

Principle D.—By localized tuberculosis is understood tuberculosis limited to a single or several parts or organs of the body without evidence of recent invasion of numerous bacilli into the systemic circulation.

Paragraph 2. The following rules shall govern the disposal of tuberculous meat:

Rule A.—The entire carcass shall be condemned—

(*a*) When it was observed before the animal was killed that it was suffering with fever.

(*b*) When there is a tuberculous or other cachexia, as shown by anemia and emaciation.

(*c*) When the lesions of tuberculosis are generalized, as shown by their presence not only at the usual seats of primary infection, but also in parts of the carcass or the organs that may be reached by the bacilli of tuberculosis only when they are carried in the systemic circulation. Tuberculous lesions in any two of the following-mentioned organs are to be accepted as evidence of generalization when they occur in addition to local tuberculous lesions in the digestive or respiratory tracts, including the lymphatic glands connected therewith: Spleen, kidney, uterus, udder, ovary, testicle, adrenal gland, brain, or spinal cord, or their membranes. Numerous uniformly distributed tubercles throughout both lungs also afford evidence of generalization.

(*d*) When the lesions of tuberculosis are found in the muscles or intermuscular tissue or bones or joints, or in the body lymphatic glands as a result of draining the muscles, bones, or joints.

(*e*) When the lesions are extensive in one or both body cavities.

(*f*) When the lesions are multiple, acute, and actively progressive. (Evidence of active progress consists in signs of acute inflammation about the lesions, or liquefaction necrosis or the presence of young tubercles.)

Rule B.—An organ or a part of a carcass shall be condemned—

(*a*) When it contains lesions of tuberculosis.

(*b*) When the lesion is immediately adjacent to the flesh, as in the case of tuberculosis of the parietal pleura or peritoneum, not only the membrane or part affected, but also the adjacent thoracic or abdominal wall is to be condemned.

(*c*) When it has been contaminated by tuberculous material, through contact with the floor, a soiled knife, or otherwise.

(*d*) All heads showing lesions of tuberculosis shall be condemned.

(*e*) An organ shall be condemned when the corresponding lymphatic gland is tuberculous.

Rule C.—The carcass, if the tuberculous lesions are limited to a single or several parts or organs of the body (except as noted in Rule A), without evidence of recent invasion of tubercle bacilli into the systemic circulation, shall be passed after the parts containing the localized lesions are removed and condemned in accordance with Rule B.

Rule D.—Carcasses which reveal lesions more numerous than those described for carcasses to be passed (Rule C), but not so severe as the lesions described for carcasses to be condemned (Rule A), may be rendered into lard or tallow if the distribution of the lesions is such that all parts containing tuberculous lesions can be removed. Such carcasses shall be cooked by steam at a temperature not lower than 220 degrees Fahrenheit for not less than four hours.

SECTION 14. Carcasses showing lesions to warrant the diagnosis of Texas fever shall be condemned.

SECTION 15. Carcasses of sheep affected with parasitic ictero-hematuria shall be condemned.

SECTION 16. Carcasses of animals affected with mange, or scab, in advanced stages, or showing emaciation or extension of the inflammation to the flesh, shall be condemned. When the disease is slight the carcass may be passed.

SECTION 17. *Paragraph 1.* Carcasses of animals affected with tapeworm cysts, known as *Cysticercus bovis* and *C. cellulosæ,* shall be rendered into lard or tallow, unless the infestation is excessive, in which case the carcass shall be condenmed.

Paragraph 2. Carcasses of animals found infested with gid bladderworms (*Cœnurus cerebralis, Multiceps socialis*) may be passed after condemnation of the infected organ (brain, spinal cord).

Paragraph 3. Carcasses or parts of carcasses found infested with the hydatid cyst (echinococcus) may be passed after condemnation of the infected part or organ.

SECTION 18. All carcasses of animals so infected that consumption of the meat or meat food products thereof may give rise to meat poisoning shall be condemned. This section covers all carcasses showing signs of—

(*a*) Acute inflammation of the lungs, pleura, pericardium, peritoneum, or meninges.

(*b*) Septicemia or pyemia, whether puerperal, traumatic, or without any evident cause.

(*c*) Severe hemorrhagic or gangrenous enteritis or gastritis.

(*d*) Acute diffuse metritis or mammitis.

(*e*) Polyarthritis.

(*f*) Phlebitis of the umbilical veins.

(*g*) Traumatic pericarditis.

(*h*) Any other inflammation, abscess, or suppurating sore if associated with acute nephritis, fatty and degenerated liver, swollen soft spleen, marked pulmonary hyperemia, general swelling of lymphatic glands, and diffuse redness of the skin, either singly or in combination.

Immediately after slaughter of any animal so diseased the premises and implements used must be thoroughly disinfected as prescribed elsewhere in these regulations. The part of any carcass coming into contact with the carcass or any part of the carcass of any animal covered by this section, other than those affected with the diseases mentioned in (*a*) above, or with the place where such animal was slaughtered, or with the implements used in the slaughter, before thorough disinfection of such place and implements has been accomplished, or with any other contaminated object, shall be condemned; in case the contaminated part is not removed from the carcass within two hours after such contact the whole carcass shall be condemned.

SECTION 19. Carcasses affected with icterus and showing an intense yellow or greenish yellow discoloration after proper cooling shall be condemned. Carcasses which exhibit a yellowish tinge directly after slaughter, but lose this discoloration on chilling, may be passed for food.

SECTION 20. Carcasses which give off the odor of urine or a strong sexual odor shall be condemned.

SECTION 21. Hogs affected with urticaria (diamond skin disease) *Tinea tonsurans, Demodex folliculorum,* or erythema may be passed after detaching and condemning the skin, if the carcass is otherwise fit for food.

SECTION 22. Carcasses of animals showing any disease, such as generalized melanosis, pseudo-leukemia, etc., which affects the system of the animal, shall be condemned.

SECTION 23. Any organ or part of a carcass which is badly bruised or which is affected by tumors, malignant or benign, abscesses, suppurating sores, or liver flukes shall be condemned; but when the lesions are so extensive as to affect the whole carcass, the whole carcass shall be condemned.

SECTION 24. Carcasses of animals too emaciated or anemic to produce wholesome meat, and carcasses which show a slimy degeneration of the fat or a serous infiltration of the muscles, shall be condemned.

SECTION 25. Carcasses of animals showing symptoms of milk fever or railroad sickness at the time of slaughter shall be condemned, as the flesh of such animals is frequently darker in color and more watery than is natural, and the present view of the pathology of at least the first disease suggests autointoxication.

SECTION 26. Carcasses of animals in advanced stages of pregnancy (showing signs of parturition), also carcasses of animals which have within ten days given birth to young and in which there is no evidence of septic infection, may be rendered into lard or tallow if desired by the manager of the establishment; otherwise they shall be condemned.

SECTION 27. Carcasses of animals too immature to produce wholesome meat, all unborn and stillborn animals, also carcasses of calves, pigs, kids, and lambs under 3 weeks of age, shall be condemned.

SECTION 28. In all cases where carcasses showing localized lesions of disease are passed or rendered into lard or tallow, the diseased parts must be removed before the "U. S. Retained" tag is taken from the carcass, and such parts shall be condemned.

SECTION 29. Hogs which have been allowed to pass into the scalding vat alive or have been suffocated in other ways shall be condemned.

SECTION 30. All animals that die in abattoir pens, and those in a dying condition before slaughter, shall be condemned and tagged as provided in Regulation 17, section 2. In conveying to the tank animals which have died in the pens of the establishment, they shall not be allowed to pass through compartments in which food products are prepared. No dead animals shall be brought into an establishment for rendering from outside the premises of said establishment unless permission is first obtained from the Chief of the Bureau of Animal Industry.

SECTION 31. When a portion of a carcass is to be condemned on account of slight bruises, the bruised portion shall be removed immediately and tanked, and the remainder of the carcass shall be marked "Inspected and Passed." When desired, a retaining room

may be provided in one part of the cooler for the retention of such carcasses until after they are chilled, when the bruised portion may be removed.

SECTION 32. Portions of intestines that show evidences of infestation with esophagostoma or other nodular affection shall be condemned.

SECTION 33. Hog carcasses found before evisceration has taken place to be affected with an infectious or contagious disease, including tuberculosis, shall not be eviscerated at the regular killing bed or bench, but shall be taken, separate from other carcasses, to the retaining room or other specially prepared place and there opened and examined.

REGULATION 14. "RETAINING" ROOMS.

SECTION 1. Separate compartments, to be known as "retaining rooms," or other special places for final inspection, shall be set apart at all official establishments, and all carcasses and parts marked with a "U. S. Retained" tag shall be held in these rooms pending final inspection. These rooms shall be rat proof, large enough for carcasses to hang separately, furnished with abundant light, and provided with sanitary tables and other necessary apparatus; the floors shall be of cement, asphalt, metal, or brick laid in cement, and shall have proper sewer connections. They shall be provided with facilities for locking, and locks for this purpose will be furnished by the Department. The keys to such locks shall remain in the custody of the inspector or his assistant. In establishments where it is impracticable or undesirable to have refrigeration in the retaining room, rooms may be constructed in the cooler for the reception and chilling of carcasses not affected with infectious diseases but which require further inspection.

SECTION 2. Retained carcasses shall be subjected to a final inspection, and immediately after this is completed those found to be wholesome and fit for human food shall be released by the veterinary inspector conducting the inspection, who shall remove the "U. S. Retained" tags, and the carcasses shall be removed from the retaining room and marked "Inspected and Passed," as provided in Regulation 17, section 5.

SECTION 3. The floors and walls of all retaining rooms shall be washed with hot water and disinfected after diseased animals are removed and before any "retained" carcasses are again placed therein.

REGULATION 15. "CONDEMNED" ROOMS.

SECTION 1. In each establishment at which condemned carcasses or meat food products are held until the day following their condemnation there shall be provided a room entirely separate from all other rooms in the establishment. This room shall be secure, rat proof, and shall be provided with a lock, the key of which shall remain in the custody of a Department employee. This room shall be known as the "condemned room," and shall be kept locked at all times except when condemned meat or meat food product is being taken into or from the said room under the supervision of a Department employee. The condemned room shall be kept clean.

SECTION 2. Carcasses or parts of carcasses found on final inspection to be unsound, unhealthful, unwholesome, or otherwise unfit for human food shall be marked "U. S. Inspected and Condemned," as provided in Regulation 17, section 4, and shall be immediately removed from the retaining room to the "condemned room," if such condemned room is provided. In case no condemned room is provided, they shall be locked in the retaining room and shall be tanked at or before the close of the day on which they are condemned.

SECTION 3. Condemned carcasses shall not be allowed to accumulate, but shall be removed from the "condemned room," denatured as provided in Regulation 16, section 3, or tanked within a reasonable time after condemnation.

SECTION 4. A truck or trucks of sufficient capacity, plainly marked, and which can be locked or sealed, shall, when required by the inspector in charge, be provided for handling condemned meat.

REGULATION 16. TANK ROOMS, TANKS, AND TANKING.

SECTION 1. All tanks and equipment used for rendering and preparing edible product shall be in compartments separate from those used for rendering inedible product, and there shall be no connection by means of pipes or otherwise between the tanks or departments containing inedible product and those containing edible product. This provision must be complied with on or before October 1, 1908.

SECTION 2. *Paragraph 1.* All condemned carcasses, parts of carcasses, and meat food products shall be tanked as follows:

Paragraph 2. After the lower opening and the draw-off valves of the tank have been securely sealed by an employee of the Department and the condemned carcasses, parts, and meat food products are placed therein in his presence, the upper opening shall be likewise securely sealed by such employee, whose duty it shall be then to see that a suffi-

cient force of steam (not less than 40 pounds, producing a temperature of 288 degrees Fahrenheit) is turned into the tank and maintained a sufficient time (not less than six hours) effectually to render the contents unfit for any edible product. Wire and lead seals are provided by the Department for sealing tanks. Proprietors of establishments are required to equip all tanks used for condemned products so that they may be securely sealed in the manner above specified.

Paragraph 3. A sufficient quantity of coloring matter or other substance to be designated by the Department shall be used in connection with the rendering of all condemned carcasses, parts of carcasses, meat, or meat food products to destroy them effectually for food purposes.

Paragraph 4. The seals of tanks containing condemned meat or the tankage thereof shall be broken only by an employee of the Department, and such employee shall supervise the drawing off of the contents of such tanks and the marking of the tallow and grease as inedible.

Paragraph 5. If an official establishment fails to permit the treatment and tanking of condemned carcasses, parts of carcasses, meat, or meat food products as required by these regulations, the inspector in charge shall report that fact to the Department, in order that inspection may be withdrawn from such establishment.

SECTION 3. Any meat or meat food products condemned at establishments which have no facilities for tanking shall be freely slashed with a knife and then denatured with crude carbolic acid or other prescribed agent, and then removed to an establishment indicated by the inspector in charge and there tanked and rendered under the supervision of an employee of the Department; or such meat or meat food products may be destroyed by incineration under the supervision of an employee of the Department.

REGULATION 17. TAGS, BRANDS, STAMPS.

SECTION 1. To each animal inspected under Regulation 11 which shows symptoms or is suspected of being affected with any disease or condition which under these regulations may cause its condemnation in whole or in part on post-mortem inspection there shall be affixed by a Department employee at the time of inspection a numbered metal tag bearing the words "U. S. Suspect," which shall remain upon the animal until final post-mortem inspection, when the carcass shall be marked according to the conditions found, and disposed of as elsewhere provided in these regulations.

SECTION 2. To the ear of each animal which is found in a dying condition or dead on the premises of an establishment there shall be affixed by a Department employee a numbered tag bearing the words "U. S. Condemned." The ear bearing the tag shall not be removed from the carcass. The number of this tag shall be reported to the inspector in charge by the employee who affixes it. This tag shall accompany the condemned carcass into the tank, and the Department employee who is supervising the tanking shall make a report of the number to the inspector in charge.

SECTION 3. Upon each carcass, or part or detached organ thereof, inspected under Regulation 12, in which any lesion of disease or other condition is found that might render the meat or any organ unfit for food purposes, and which for that reason would require a subsequent inspection, there shall be placed by a Department employee at the time of inspection a tag, numbered in duplicate, bearing the words "U. S. Retained," and such other marks of identification shall be used as shall be approved by the Chief of the Bureau of Animal Industry. The inspector who attaches this "U. S. Retained" tag shall detach the numbered stub thereof and forward it with his report to the inspector in charge. The other portion shall accompany the carcass to the retaining room.

SECTION 4. Each carcass, or part or detached organ thereof, which is found on final inspection to be unsound, unhealthful, unwholesome, or otherwise unfit for human food shall be marked conspicuously by a Department employee at the time of inspection with the words "U. S. Inspected and Condemned." The "U. S. Retained" tag shall accompany the carcass into the tank, and the number thereof shall be reported by the employee who supervises the tanking. If, however, upon final inspection the carcass or part thereof is passed, the "U. S. Retained" tag shall be removed and returned to the inspector in charge. A record of the tag showing the serial number, the final disposal of the carcass or part to which it was affixed, the date, and the name of the inspector shall be forwarded with the regular reports to the inspector in charge.

SECTION 5. Upon all passed carcasses slaughtered under inspection there shall be placed by an employee of the Department, or by an employee of the establishment under the supervision of an employee of the Department, meat-inspection marks bearing the words "Inspected and Passed," or an authorized abbreviation thereof, and such other matter as may be required by the Department. The number of marks, their location on the carcass, and the time they shall be affixed, shall be determined by the Chief of the Bureau of Animal Industry.

10765—10——29

SECTION 6. *Paragraph 1.* Each passed primal part or the true container thereof must be marked, under the supervision of a Department employee, with the words "Inspected and Passed," or an authorized abbreviation thereof, and the official establishment number, except as provided in paragraphs 2 and 3 of this section and in section 12 of Regulation 25.

Paragraph 2. When primal parts are shipped from one official establishment to another for further processing, it is not obligatory that the inspection legend appear on such primal parts, but the container thereof in the case of a package shall be marked as specified in section 9 of this regulation, and in the case of a car shall be sealed; in such cases the primal parts, after processing, shall show plainly the inspection legend and the number of the official establishment at which the processing was completed.

Paragraph 3. Passed primal parts of pork intended for export need not be marked with the authorized marks of inspection, but all outside containers shall bear the meat-inspection stamp.

SECTION 7. The inspection legend or an authorized abbreviation thereof may be affixed, under the supervision of a Department employee, to hams, bacon, and similar primal parts with a hot branding iron, and when so affixed will be recognized as the official mark of inspection. When hot branding irons are used to affix trade brands or descriptions, such brand or description must be distinct and apart from the inspection legend.

SECTION 8. Upon all meat food products which are suspected on reinspection of being unsound, unhealthful, unwholesome, or otherwise unfit for human food, or upon the containers thereof, there shall be placed by a Department employee at the time of reinspection the "U. S. Retained" tags hereinbefore described. The employee who affixes the tag shall send the numbered stub with his report to the inspector in charge. These tags shall accompany the said meats or meat food products to the retaining room or other special place for final inspection. When the final inspection is made, if the meat or meat food product be condemned, the "U. S. Retained" tag shall be stamped "U. S. Inspected and Condemned," and shall accompany the condemned meat or meat food product to the tank, and the inspector shall report his action to the inspector in charge. If, however, upon final inspection the meat or meat food product is passed for food, the inspector shall stamp the retained tag "Inspected and Passed" and return the tag with his report to the inspector in charge.

SECTION 9. When meat products for domestic trade have been inspected and passed, the outside containers of such meat shall bear (in lieu of meat-inspection stamp) a domestic meat label which has been submitted to and approved by the Department, showing the official establishment number and the following legend: "The meat contained herein has been inspected and passed under the provisions of the act of June 30, 1906." The firm name may also appear on the label if desired. The dimensions of the label shall be not less than 4 inches by 2¾ inches. Outside containers if bearing approved trade labels are not required to be provided with the label above described. Domestic meat labels shall be affixed to packages in the manner prescribed in Regulation 24 for affixing labels to export packages.

SECTION 10. Each outside container (except cloth wrappings) of export meat or meat food products shall be marked with a meat-inspection stamp. The cloth wrappings of inspected and passed meat which is so marked shall be marked with an authorized mark of inspection.

SECTION 11. Upon each container of meat or meat food products, such as ham, bacon, etc., prepared for export with preservatives under Regulation 22, section 3, paragraph 1, there shall be placed, under the personal supervision of a Department employee, a special stamp for marking such meats, known as the "Preservative" stamp. All outside containers of such meat or meat food products shall bear the "Preservative" stamp.

REGULATION 18. TRADE LABELS.

SECTION 1. Upon each can, pot, tin, canvas, or other receptacle or covering containing any meat or meat food product, which meat or meat food product does not bear the marks "Inspected and Passed," there shall be securely affixed, under the supervision of a Department employee, a trade label before such meat or meat food product leaves an official establishment. This trade label shall contain, in plain letters and figures of uniform size, the words "U. S. Inspected and Passed," the number of the official establishment at which the meat or meat food product is last processed, and the true name of the meat or meat food product contained in such package. The words "under the act of Congress of June 30, 1906," may be placed upon the label after the words "U. S. Inspected and Passed." An inspector shall not allow trade labels to be affixed until he is satisfied that the contents of the package are sound, healthful, wholesome, and fit for human food, in accordance with the statements on the label.

SECTION 2. Duplicate copies of each trade label in the form of sketches or proofs shall first be submitted to the Department, and no trade label shall be used until a sketch or

proof thereof has been approved. After trade labels are printed from approved proofs or sketches they shall be forwarded in triplicate to the Department for approval and filing.

SECTION 3. No trade label bearing the words "U. S. Inspected and Passed," or any abbreviation or simulation thereof, shall be used on meat or meat food products which have not been inspected and passed under these regulations, and no trade label bearing the inspection legend, or any abbreviation or simulation thereof, shall be placed upon meat or meat food products except under the supervision of an inspector.

SECTION 4. Tin containers, embossed or lithographed with the label as prescribed in section 1, will be considered as bearing trade labels. On and after October 1, 1908, all sealed tin containers must have the number of the official establishment where packed embossed, lithographed, or printed thereon.

SECTION 5. The essential features of a trade label are as follows, and shall appear upon each label:

The true name of the product.

The inspection legend.

The establishment number.

SECTION 6. The inspection legend "U. S. Inspected and Passed," or an authorized abbreviation thereof, and the official establishment number in plain characters of uniform size, which shall be in proper proportion to the general lettering of the label, must be separately and prominently embodied in all trade labels.

SECTION 7. In the case of meat contained in cartons, or in wrappers of paper, cloth, or other similar substance, the inspection legend and the official establishment number may be embodied in a sticker or seal of proportionate size prominently displayed with the trade label but not necessarily a part of the trade label, such stickers or seals to be approved by the Department of Agriculture. It is not permissible to affix to meat or meat food products a detachable device of any kind which bears the inspection legend.

SECTION 8. While labels to be affixed for foreign shipment may be printed in a foreign language, the same rules shall apply with reference to false labeling and the naming of ingredients as shall apply to goods prepared for domestic use. The inspection legend and the official establishment number must in all cases appear in English; but if desired they may in addition, literally translated, appear in the language of the country to which the package is destined.

SECTION 9. *Paragraph 1.* When an article is prepared by an official establishment for another firm or individual, if the name of the said firm or individual is to appear upon the label the statement must be made that the article was "prepared for" or "manufactured for" the firm or individual. Names of subsidiary companies which have legal entity may be used without the prefix "prepared for" or "manufactured for."

Paragraph 2. When a firm or individual not operating under Federal inspection desires to reship inspected and passed meat that has been processed only under Government inspection and is eligible under these regulations for interstate shipment he may affix to the package the following statement: "The meat contained herein has been inspected and passed at an establishment where Federal inspection is maintained."

SECTION 10. No meat or meat food products shall be sold or offered for sale by any person, firm, or corporation under any false or deceptive name; but the established trade name or names which are usual to such products, which are not false and deceptive and which shall be approved by the Secretary of Agriculture, are permitted.

SECTION 11. No picture, design, or device which gives any false indication of origin or quality shall be used upon any label. The law prohibits any statement, design, or device false in any particular regarding the virtues or properties of the materials contained in the package.

SECTION 12. A meat food product when composed of more than one ingredient shall not bear a trade label with a name stating or purporting to show that the said meat food product is a substance which is not the principal ingredient contained therein, even though such name be an established trade name.

SECTION 13. A meat food product that contains a substance or substances, including water, added for the purpose of adulteration and which lessens its food value shall bear a label stating that such substance or substances have been added.

SECTION 14. When any weight is given upon the true container it must be the correct weight, and it must be stated whether this weight is the net weight or the gross weight.

REGULATION 19. REINSPECTION.

SECTION 1. Immediately before shipment and at such other times as may be deemed necessary all carcasses or parts thereof, whether fresh or cured, that have been previously inspected and passed shall be reinspected by the inspector in charge or his assistants, in such manner as shall be prescribed by the Chief of the Bureau of Animal Industry, and if upon any such reinspection any carcass or part thereof is found to have

become unsound, unhealthful, unwholesome, or in any way unfit for human food the original mark, stamp, tag, or label shall be destroyed or defaced and the carcass or part shall be condemned.

SECTION 2. Except as provided in Regulation 20, only carcasses and parts thereof, meat, or meat food products which have not been processed except under Government supervision, and which can by marks, seals, brands, or labels be identified as having been previously inspected and passed by a Department employee, shall be taken into or allowed to enter an official establishment. All such carcasses, parts, meat, or meat food products which are brought into one official establishment from another, or which are returned to the establishment from which they issued, shall be identified and reinspected at the time of receipt, and shall be subject to further reinspection in such manner and at such times as may be deemed necessary. If upon any such reinspection any carcass or part thereof, or meat or meat food product, is found to have become unsound, unhealthful, unwholesome, or in any way unfit for human food, the original mark, stamp, tag, or label shall be defaced or destroyed, and the carcass, part, meat, or meat food product shall be condemned.

SECTION 3. Special docks and receiving rooms shall be designated by the establishment for the receipt and inspection of all meat or meat food products, and no meat or meat food products shall be allowed to enter the establishment except in the presence of a Department employee.

SECTION 4. Unrendered fats from carcasses which have been inspected and passed may be returned and received into official establishments, provided the fats have been handled in a sanitary manner after leaving the establishment, and provided further that upon inspection the fats are found to be clean, sweet, wholesome, and fit for human food. However, the return of such fats to official establishments and the manner in which they shall be handled from the time they leave such establishments until their return thereto shall be governed by such specific instructions as may be issued from time to time by the Chief of the Bureau of Animal Industry.

SECTION 5. Inedible fats may be received only into the tank room provided for inedible products, and when so received they shall not enter any compartment used for edible products.

SECTION 6. *Paragraph 1.* In order to provide for the interstate transportation, from public markets and other places, of portions of inspected and passed carcasses, parts, and meat food products which, when cut or otherwise removed from a marked carcass, part, or container, do not show the inspection mark and can not therefore be identified as having been inspected and passed, market inspection may be furnished. Each city in which market inspection is established will be assigned a number, and all products forwarded under such inspection shall bear the inspection legend and the official number assigned to the city.

Paragraph 2. Unmarked portions which are cut from the marked carcass or part, or are removed from the marked container for interstate transportation, shall be marked by a Department employee. Wherever practicable the brand shall be applied to the meat itself; where this can not be done the true container of the meat or meat food product shall be marked as required by the Chief of the Bureau of Animal Industry.

Paragraph 3. All market stalls or other places which are given market inspection shall be maintained in a sanitary condition and shall also conform to the requirements of the Department governing the use of drugs, chemicals, dyes, and preservatives.

REGULATION 20. CARCASSES OF ANIMALS NOT INSPECTED ANTE-MORTEM.

SECTION 1.[a] Carcasses of animals which have had no ante-mortem inspection by inspectors of the Bureau of Animal Industry will not, except as hereinafter provided, be admitted into an official establishment. The exception to this rule applies only to carcasses to which the head and all viscera, except the stomach, bladder, and intestines, are held by the natural attachments. Such carcasses, if offered for admission into official establishments, shall be inspected, and if found to be free from disease and otherwise sound, healthful, wholesome, and fit for human food they shall be marked "Inspected and Passed" and admitted. If found to be diseased, unsound, unhealthful, unwholesome, or otherwise unfit for human food, they shall be marked "U. S. Inspected and Condemned," and the proprietor of the establishment shall be required to destroy them for food purposes, as provided in Regulation 16, section 2.

REGULATION 21. TANK CARS.

SECTION 1. Tank cars carrying edible meat food products into interstate or foreign commerce shall be provided with proper appliances for sealing and be securely sealed with seals furnished by the Department and affixed by Department employees.

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[a] Formerly Regulation 62, B. A. I. Order 137.

SECTION 2. When such products for export are transferred from tank cars to other containers on boats, such transfer shall be under Government supervision, and the said containers on boats shall likewise be sealed.

REGULATION 22. DYES, CHEMICALS, AND PRESERVATIVES.

SECTION 1. No meat or meat food product shall contain any substance which lessens its wholesomeness, nor any drug, chemical, dye, or preservative, except as hereinafter provided.

SECTION 2. *Paragraph 1.* There may be added to meat or meat food products common salt, sugar, wood smoke, vinegar, pure spices, and saltpeter. Only such coloring matters as may be designated by the Secretary of Agriculture as being harmless may be used, and these only in such manner as the Secretary of Agriculture may designate.

Paragraph 2. Substances necessary for the preparation, clarification, or refining of meat food products will be permitted to be used subject to the approval of the Secretary of Agriculture, provided they are eliminated from the meat food products during the further process of manufacture.

SECTION 3. *Paragraph 1.* In accordance with the written direction of the foreign purchaser or his agent, meat or meat food products prepared for export may contain preservatives of a kind and in proportions which do not conflict with the laws of the foreign country to which they are to be exported; but when such meat or meat food products are prepared for export under this regulation they shall be prepared in compartments of the establishment separate and apart from those in which meat or meat food products are prepared for the domestic trade, and such products shall be kept separate. Distinctive export certificates and stamps will be issued for meat or meat food products of this character, but, if the products are not exported, under no circumstances shall they be allowed to enter domestic trade.

Paragraph 2. The packing of meat which is prepared, as provided in paragraph 1 of this section, with any preservative not permitted by paragraph 1, section 2, may be done in the regular packing room, provided that no other meat is allowed in the packing room during the time of such packing. After such packing is completed the packing room shall be thoroughly cleansed of the preservative before the packing of other meat therein is resumed. A separate compartment constructed of tight partitions or walls shall be set apart for storing the preservative trays and other appliances used in connection with the packing. The Department will furnish a lock and key for this compartment, and the packing of all meat under this section shall be conducted under the personal supervision of an employee of this Department.

REGULATION 23. PREPARATION OF MEAT AND MEAT FOOD PRODUCTS.

SECTION 1. All processes used in curing, pickling, rendering, canning, or otherwise preparing meat or meat food products in official establishments shall be supervised by Department employees. No fixtures or appliances, such as tables, trucks, trays, tanks, vats, machines, implements, cans, or containers of any kind shall be used unless they are clean and sanitary. All steps in the process of manufacture shall be conducted carefully and with strict cleanliness. All salt, pickling fluids, and other solutions or substances used in curing meat must be clean.

SECTION 2. Canned meat or meat food products which require sterilization to preserve them must be subjected to this process on the same day that the cans are filled. Defective or leaking cans discovered after the process of sterilization has been completed shall not be repaired or repacked (unless such repairing or repacking is done within six hours of the time of original sterilization), but the contents of such cans shall be removed and condemned.

SECTION 3. Potato flour shall not be used in the preparation of sausage, nor shall excessive quantities of cereals or water be used.

SECTION 4. *Paragraph 1.* The manufacture of all fats into lard, tallow, oils, and stearin at official establishments shall be closely supervised by employees of the Department, who shall see that all portions of carcasses rendered into edible product are clean and wholesome.

Paragraph 2. Heads rendered into edible product shall first be split, cross sectioned, and thoroughly washed and cleaned.

Paragraph 3. When hogs' feet are used for lard, the hair, hoofs, and the tissues of the interdigital spaces must be removed.

Paragraph 4. All pipes and similar conveyers used in conducting edible fats from one receptacle or container to another shall be of a distinctly different color from the pipes and similar conveyers used in conducting inedible fats from one receptacle or container to another.

Paragraph 5. Blueprints or other accurate diagrams showing all underground pipe lines or other conveyers used to conduct edible and inedible products at official establishments and also those extending from official establishments to other establishments, either offi-

cial or unofficial, with a description giving the exact location, terminals, and dimensions of such pipes, or other conveyers, and of all gates, valves, or other controlling apparatus, shall be filed with the Department, and a copy of such prints or diagrams shall be filed with the inspector in charge. The prints or diagrams should designate the lines used for conveying edible products and those used for conveying inedible products. If no such underground pipes or conveyers are used for the purposes above indicated, a written statement certifying to this fact and duly signed by the management of each establishment shall be filed with the Department.

Paragraph 6. All containers, such as vats and tierces, in which white grease or other inedible meat products are placed, shall be plainly marked "inedible" in such a manner that they can be readily identified.

Paragraph 7. Final containers, such as tierces, shall be appropriately marked on both ends immediately after filling.

SECTION 5. The only animal casings that may be used as containers in the manufacture of sausage under these regulations are those from cattle, hogs, sheep, or goats.

REGULATION 24. STAMPS FOR EXPORT PACKAGES.

SECTION 1. *Paragraph 1.* Numbered meat-inspection stamps shall be affixed to packages (except those in cloth wrappings) containing meat or meat food products to be shipped or otherwise transported in foreign trade.

Paragraph 2. Stamps shall be affixed in the following manner, and when they have been affixed they shall be covered immediately with a coating of transparent varnish or other similar substance:

(*a*) The stamp may be affixed in a grooved space made by removing a portion of the wood of sufficient size to admit the stamp.

(*b*) The stamp may be placed on either end of the package, provided that the sides are made to project at least one-eighth of an inch to afford the necessary protection from abrasion.

SECTION 2. Inedible-product stamps and certificates may, upon request, be issued to accompany shipments for export of casings, bladders, bungs, hoofs, and other similar inedible animal products.

REGULATION 25. TRANSPORTATION.[a]

SECTION 1. Upon the application of the exporter the inspector in charge of an establishment is authorized to issue certificates for export shipments of inspected and passed meat or meat food products. The certificate should be issued at the time the product leaves the establishment; if, however, the certificate is not issued at that time, it can only be issued upon identification and reinspection of the product.

SECTION 2. These certificates shall be issued in serial numbers and in triplicate form. Each certificate shall show the names of the exporter and the consignee, the destination, the numbers of the stamps attached to the article to be exported, the shipping marks, the kind of product, and the weight.

SECTION 3. Only one certificate shall be issued for each consignment unless otherwise directed by the Chief of the Bureau of Animal Industry.

SECTION 4. Both the original and duplicate certificates shall be delivered by the inspector to the shipper. The copy of certificate provided by law to be delivered to the chief officer of the vessel shall be the duplicate copy and shall be filed with the customs officers at the time of filing the master's manifest or the supplemental manifest.

SECTION 5. No master of any steam or sailing vessel shall receive for transportation or transport from the United States to Great Britain or Ireland, or any of the countries of continental Europe, or to Argentina or Mexico, any carcass, part of carcass, or meat food product of cattle, sheep, swine, or goats, except ship stores, unless and until a certificate of inspection covering the same has been issued and delivered as provided in this regulation. The requirement of export certificates is waived for meat and meat food products to foreign countries other than those hereinbefore named.

SECTION 6. When inedible grease, inedible tallow, or inedible stearin derived from cattle, sheep, swine, or goats is offered for export, the collectors of customs, under instructions from the Secretary of Commerce and Labor, will require an affidavit from the exporter that the products to be exported are inedible and are not intended for food purposes.

SECTION 7.[a] No person, firm, or corporation shall receive for transportation or transport from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia any carcass, part of carcass, or meat food product of cattle, sheep, swine, or goats unless and until a certificate is made and furnished in one of the forms prescribed in sections 11, 12, 13, and 14 of this regulation, showing

[a] The transportation of meat or meat food product from one point in a State or Territory to another point in the same State or Territory, when in course of shipment the meat or meat food product is taken through another State or Territory, is interstate commerce.

that such meat or meat food product has been either inspected and passed or exempted from inspection, according to act of Congress of June 30, 1906: *Provided*, That printed certificates in the forms formerly required and now on hand may be used for this purpose. It is necessary, as old stocks of printed certificates are exhausted, that new ones be printed in the new forms.

SECTION 8.[a] When any shipment of meat or meat food products covered by these regulations is offered to any common carrier for carriage within the United States as a part of a foreign movement, the same certificate shall be required as if the shipment was destined to a point within the United States.

SECTION 9.[a] *Paragraph 1.* Shipments of inspected and passed meat or meat food products that are so marked may be diverted from the original destination without a reinspection of the product, if a new certificate showing the changed destination be given to the carrier by the owner or shipper, who may or may not be the original shipper; or in case of a wreck or other extraordinary emergency the carrier may divert such shipments from the original destination without a new shipper's certificate.

Paragraph 2. The Government seals on a car containing inspected and passed meat or meat food products may be broken by the carrier in case of wreck or other extraordinary emergency, and if necessary the product may be reloaded into another car or the shipment may be diverted from the original destination without another shipper's certificate; but in all such cases the carrier shall immediately report the transaction by telegraph to the Chief of the Bureau of Animal Industry, Washington, D. C. Such report shall include the information indicated below:

(*a*) Nature of the emergency.
(*b*) Place where seals were broken.
(*c*) Original points of shipment and destination.
(*d*) Number and initials of the original car.
(*e*) Number and initials of the car into which the product is reloaded.
(*f*) New destination of the shipment.
(*g*) Kind and amount of product.

SECTION 10.[b] Reshipments of inspected meat or meat food products which are sound and wholesome at the time of reshipment may be made without reinspection when the meat or meat food products, or the containers thereof, are marked "Inspected and Passed," and the meat or meat food products have not been processed since they were originally shipped under section 11 of this regulation. Also jobbers, wholesalers, or others who do no processing, and who receive "Inspected and Passed" meat or meat food products, may break bulk, repack, and reship the same into interstate commerce under section 11 of this regulation, if each piece of meat or meat food product in the unmarked package bears the original authorized mark of Government inspection. Inspection shall be maintained at the establishments of all such jobbers, wholesalers, or others who do any processing.

SECTION 11.[c] When any carcass, part of carcass, or meat food product of cattle, sheep, swine, or goats which has been inspected and passed and so marked under these regulations is offered to any common carrier for transportation from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia for interstate shipment only, or for interstate shipment as part of a foreign movement, or for foreign shipment, the person, firm, or corporation offering such carcass, part of carcass, or meat food product shall make a certificate in the following form and deliver the same to the said common carrier, except as provided in section 12 of this regulation.

Date________________________, 190___

Name of common carrier____
Shipper____
Point of shipment ____
Consignee____
Destination ____

I hereby certify that the meat or meat food products described herein, which are offered for shipment in interstate or foreign commerce, have been inspected and passed according to act of Congress of June 30, 1906, are so marked, and at this date are sound, healthful, wholesome, and fit for human food.

Kind of product.	Amount and weight.
________________________________	________________________________
________________________________	________________________________
________________________________	________________________________

____
(Signature of shipper.)

____
(Address of shipper.)

[a] Formerly Regulation 52, B. A. I. Order 137.
[b] Formerly Meat Inspection Rulings 1 A.
[c] Formerly Regulation 53, B. A. I. Order 137.

This certificate may be stamped upon or incorporated in any form which is regularly or ordinarily used in the shipment of meat or meat food products.

SECTION 12.[a] *Paragraph 1.* An official establishment may ship from the said establishment to any other official establishment any meat or meat food product which has been inspected and passed under these regulations without marking the same "Inspected and Passed," if such shipment be placed in a railroad car which is sealed by an employee of the Bureau of Animal Industry, and provided that not less than 25 per cent of the contents of each car consists of meat or meat food products not marked "Inspected and Passed."

Paragraph 2. Wagons so equipped that they can be securely sealed by a Department employee may be considered as true containers.

Paragraph 3. When shipments are made under paragraph 1 of this section the shipper shall make for each car and deliver to the common carrier in duplicate a certificate in the following form:

Date________________________, 190___

Name of common carrier____
Establishment number of consignor____________________________________
Point of shipment____
Establishment number of consignee____________________________________
Destination____
Car number and initials____

I hereby certify that the following-described meat or meat food products have been inspected and passed according to act of Congress of June 30, 1906. They are not marked "Inspected and Passed," but have been placed in the above car under the supervision of an employee of the Bureau of Animal Industry which was sealed by him with Government seals Nos. ____ and____

Kind of product.	Amount and weight.
____________________	____________________
____________________	____________________
____________________	____________________

____
(Signature of shipper.)

____
(Address of shipper.)

The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C. Attention is directed to the law which provides a penalty of fine and imprisonment for any unauthorized person who breaks a seal on such cars.

When shipments are made under this section the inspector in charge at point of origin shall duly notify the Chief of the Bureau of Animal Industry and the inspector in charge at point of destination.

SECTION 13.[b] When any carcass, part of carcass, or meat food product of cattle, sheep, swine, or goats which has not been inspected under these regulations is offered for shipment from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia by any retail butcher or retail dealer who holds a certificate of exemption issued by the Secretary of Agriculture, the common carrier shall require a certificate to be made in duplicate in the following form by said retail butcher or retail dealer, which certificate shall in all cases show the exemption number designated by the Secretary of Agriculture for said retail butcher or retail dealer:

Date________________________, 190___

Name of common carrier____
Shipper ____
Point of shipment____
Consignee ____
Destination____
Number of exemption certificate______________________________________

I hereby certify that I am a retail butcher or a retail dealer in meat or meat food products; that the following-described meat or meat food products are offered for shipment in interstate commerce to a customer, as exempted from inspection according to act of Congress of June 30, 1906, under certificate issued to me by the United States Department of Agriculture, and that at this date they are sound, healthful, wholesome, and fit for human food, and contain no preservative or coloring matter or other substance prohibited by the regulations of the Secretary of Agriculture governing meat inspection.

Kind of product.	Amount and weight.
____________________	____________________
____________________	____________________
____________________	____________________

____
(Signature of shipper.)

____
(Address of shipper.)

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[a] Formerly Regulation 54, B. A. I. Order 137.
[b] Formerly Regulation 55, B. A. I. Order 137.

The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C. This certificate shall be separate and apart from any waybill, bill of lading, or other form ordinarily used in the shipment of meat.

SECTION 14.[a] When any cattle, sheep, swine, or goats have been slaughtered by any farmer on the farm, and the carcasses, parts of carcasses, or meat food products thereof are offered to any common carrier for transportation from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia, the common carrier may so transport such carcasses, parts of carcasses, or meat food products as long as the same may be identified as of animals slaughtered by any farmer on the farm.

Date_______________________, 190___

Name of common carrier____
Shipper____
Consignee____
Point of shipment____
Destination____

I hereby certify that the following-described uninspected meat or meat food products are from animals slaughtered by a farmer on the farm, and are offered for transportation in interstate commerce as exempted from inspection according to act of Congress of June 30, 1906, and that at this date they are sound, healthful, wholesome, and fit for human food, and contain no preservative or coloring matter or other substance prohibited by the regulations of the Secretary of Agriculture governing meat inspection.

Kind of product.	Amount and weight.
_______________________________	___________________________
_______________________________	___________________________
_______________________________	___________________________

____
(Signature of shipper.)

____
(Address of shipper.)

The duplicate certificate shall be forwarded immediately by the initial carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

SECTION 15.[b] All original certificates delivered to the common carrier, as required by this regulation, shall be filed and retained for one year by the initial carrier, in order that they may be readily checked by this Department in such manner as the Secretary of Agriculture may from time to time prescribe.[c]

SECTION 16.[d] All waybills, transfer bills, running slips, or conductor's cards accompanying an interstate or foreign shipment of meat or meat food product must have embodied in, stamped upon, or attached to it a signed statement which shall be evidence to connecting carriers that the proper shipper's certificate as required by sections 11, 12, 13, and 14 of this regulation is on file with the initial carrier, and no connecting carrier shall receive for transportation or transport any interstate or foreign shipment of meat or meat food product unless the waybill, transfer bill, running slip, or conductor's card accompanying the same includes the aforesaid signed statement in one of the following forms:

When shipment is made under section 11 or 12:

(Name of transportation company.)

United States inspected and passed as evidenced by shipper's certificate on file with initial carrier.

(Signed) ________________, *Agent.*

When shipment is made under section 13 or 14:

(Name of transportation company.)

Exempted from inspection as evidenced by shipper's certificate on file with initial carrier.

(Signed) ________________, *Agent.*

SECTION 17.[e] *Paragraph 1.* When any carcass, part of carcass, or meat food product of cattle, sheep, swine, or goats loaded on a truck, wagon, cart, or other vehicle, or otherwise prepared for shipment, is offered for transportation or transported by ferry, such ferry being the initial carrier from one State, Territory, or the District of Columbia to another State, Territory, or the District of Columbia, the person, firm, or corporation offering such carcass, part of carcass, or meat food product shall, except as hereinafter provided by paragraph 5, make a certificate in one of the forms hereinafter indicated and deliver the certificate to said common carrier; and no person, firm, or corporation operating a ferry line as aforesaid shall receive for transportation or transport any car-

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[a] Formerly Regulation 56, B. A. I. Order 137.

[b] Formerly Regulation 57, B. A. I. Order 137.

[c] Stocks of printed certificates now on hand may be used, but as new supplies are printed they should conform to the forms prescribed.

[d] Formerly Regulation 58, B. A. I. Order 137.

[e] Formerly Regulation 65, B. A. I. Order 137.

cass, part of carcass, or meat food product of cattle, sheep, swine, or goats loaded on a truck, wagon, cart, or other vehicle, or in any other manner prepared for transportation, unless a certificate in one of the forms referred to is properly filled out and delivered by the shipper as herein required.

Paragraph 2. When the shipment consists of inspected and passed meat or meat food products, the form of certificate shown in section 11 of this regulation shall be used.

Paragraph 3. When the shipment is made under exemption and consists of meat or meat food product which has not been inspected and passed, the form of certificate shown in section 13 of this regulation shall be used, and a duplicate shall be forwarded immediately by the ferry company to the Chief of the Bureau of Animal Industry, Washington, D. C.

Paragraph 4. When the shipment consists of meat or meat food products from animals slaughtered by a farmer on the farm and which have not been inspected and passed, the form of certificate shown in section 14 of this regulation shall be used, and a duplicate shall be forwarded immediately by the ferry company to the Chief of the Bureau of Animal Industry, Washington, D. C.

Paragraph 5. When a shipper's certificate for meat or meat food products has been issued and is on file with the initial carrier and that fact is shown by notation on the billing, the ferry company need not require another certificate.

SECTION 18.[a] Imported meat or meat food products which have not been mixed or compounded with or added to domestic meat or meat food products may be transported by any common carrier from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia if the packages containing them are marked "Inspected under the Food and Drugs Act of June 30, 1906," when received for transportation.

SECTION 19.[b] *Paragraph 1.* Meat or meat food products which have been inspected and passed and so marked, and which have been transported from the establishments in which they were prepared into the channels of trade, and which are alleged or known to have become unsound, unwholesome, or otherwise unfit for human food, may be transported in interstate commerce only under the following restrictions:

Paragraph 2. Meat or meat food products inspected and passed and so marked and which are alleged to be unsound, unwholesome, or otherwise unfit for human food may be shipped from one State or Territory or the District of Columbia to any official establishment in the same or a different State or Territory if a written permit in duplicate for such shipment be first obtained from the inspector in charge of the establishment to which the shipment is destined. In all such shipments both the original and duplicate copies of the permits shall be surrendered to the carrier accepting the meat or meat food product, and the carrier shall require the shipper to furnish three copies of the form of certificate hereinafter given. One of these certificates and the duplicate copy of the permit shall be retained by the carrier; another copy of the certificate, together with the original permit, shall be mailed by the carrier to the Chief of the Bureau of Animal Industry, Washington, D. C., and the third copy of the certificate shall be addressed and mailed by the carrier to the Bureau of Animal Industry inspector in charge at the point to which the shipment is consigned. Upon the arrival of the shipment at the establishment the inspector in charge shall cause a careful inspection to be made of the shipment, to determine whether or not it is unsound, unwholesome, or otherwise unfit for food. Should the meat or meat food product contained in the shipment prove to be unsound, unwholesome, or otherwise unfit for human food, it shall at once be stamped "U. S. Inspected and Condemned" and be immediately tanked or removed to the condemned room. If the meat or meat food product contained in the shipment shall prove to be sound, wholesome, and fit for human food, the inspector shall allow the meat or meat food product to enter the establishment. Meat or meat food products at an official establishment alleged or known to be unsound, unwholesome, or otherwise unfit for human food shall not be shipped under this paragraph, but must be disposed of at the establishment.

Paragraph 3. Meat or meat food products which have been inspected and passed and are so marked and are alleged to be unsound, unwholesome, or otherwise unfit for human food may be returned from one State or Territory or the District of Columbia to any jobber, wholesaler, or other dealer from whom the said meat or meat food product was purchased, if a written permit, in duplicate, for such shipment be first obtained from the Chief of the Bureau of Animal Industry. In all such shipments both the original and duplicate copies of the permits shall be surrendered to the carrier accepting the meat or meat food product, and the carrier shall require the shipper to furnish two copies of the form of certificate hereinafter given. One of these certificates and the duplicate copy of the permit shall be retained by the carrier, and the other copy of the certificate, together with the original permit, shall be mailed by the carrier to the Chief of the Bureau of

[a] Formerly Regulation 64, B. A. I. Order 137.
[b] Formerly Regulation 61, B. A. I. Order 137.

Animal Industry, Washington, D. C. If the meat or meat food product which is shipped under this section shall prove to be unsound, unwholesome, or otherwise unfit for human food it may not be reshipped in interstate commerce as a food product.

Paragraph 4. The shipper's certificate required by paragraphs 2 and 3 of this section shall be in the following form, and shall in all cases show a description and the weight of the meat or meat food product: [a]

Date ______________________, 190__

Name of common carrier ____
Consignor ____
Point of shipment ____
Consignee ____
Destination ____
Number of permit ____

I hereby certify that the following-described meat or meat food products have been inspected and passed according to the act of Congress of June 30, 1906, and are so marked. It is alleged that the said meat or meat food products are unsound, unhealthful, unwholesome, and unfit for human food.

Kind of product.	Amount and weight.
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________

____
(Signature of shipper.)

____
(Business or occupation of shipper.)

____
(Address of shipper.)

As evidence to connecting carriers that the proper shipper's certificate as required by this paragraph is on file with the initial carrier, the waybills, transfer bills, running slips, or conductor's cards accompanying the shipments of meat or meat food products, made under paragraphs 2 and 3 of this section, must have embodied in, stamped upon, or attached to the same a signed statement in the following form:

(Name of railroad company.)

Meat or meat product alleged to be unsound, unwholesome, or otherwise unfit for food as evidenced by shipper's certificate on file with initial carrier.

(Signed) ______________________ *Agent.*

Paragraph 5. Uninspected meat or meat food product, or meat or meat food product inspected and marked and which is known to have become unsound, unwholesome, or otherwise unfit for human food, or inedible grease or tallow or other fat, may be shipped from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia or to a foreign country for industrial purposes. No such shipment shall be accepted by any carrier unless and until the product which is known to be unsound, unwholesome, or otherwise unfit for food shall have been denatured or otherwise rendered unavailable for food purposes. The carrier shall require the shipper to certify in writing that the meat or meat food product has been so denatured or otherwise rendered unavailable for food purposes. This certificate of the shipper that the meat or meat food product has been denatured shall be forwarded by the carrier to the Chief of the Bureau of Animal Industry, Washington, D. C. It is suggested that the shipper's certificate of denaturing required for shipments made under this paragraph be in the following form:

Date ______________________, 190__

Name of common carrier ____
Consignor ____
Point of shipment ____
Consignee ____
Destination ____

I hereby certify that the following-described inedible meat or meat food products have been denatured or otherwise rendered unavailable for food purposes.

Kind of product.	Amount and weight.
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________

____
(Signature of shipper.)

____
(Business or occupation of shipper.)

____
(Address of shipper.)

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[a] Attention is directed to the meat-inspection law, which provides a penalty of a fine of $10,000 and imprisonment for two years for any person who ships for human consumption in interstate or foreign trade any meat or meat food product which is unsound, unwholesome, or otherwise unfit for human food.

As evidence to connecting carriers that the proper shipper's certificate is on file with the initial carrier, the waybills, transfer bills, running slips, or conductors' cards accompanying the shipment of meat or meat food product under this paragraph must have embodied in, stamped upon, or attached to the same a signed statement in the following form:

(Name of railroad company.)

Unsound, unwholesome, or otherwise unfit for food, and denatured or otherwise rendered unavailable for food purposes, as evidenced by shipper's certificate on file with the initial carrier.

(Signed) ________________________ *Agent.*

REGULATION 26. COUNTERFEITING, ETC.

SECTION 1. It is a misdemeanor, punishable by fine and imprisonment, for any person, firm, or corporation, or officer, agent, or employee thereof, to forge, counterfeit, simulate, or falsely represent, or without proper authority to use, fail to use, or detach, or knowingly or wrongfully to alter, deface, or destroy, or to fail to deface or destroy, any of the marks, stamps, tags, labels, or other identification devices provided for by law, or by these regulations, on any carcasses, parts of carcasses, or the food product, or the containers thereof, or wrongfully to use, deface, or destroy any certificate provided for by law or by these regulations.

REGULATION 27. REPORTS.

SECTION 1. Reports of the work of inspection carried on in every official establishment shall be forwarded to the Department by the inspector in charge, on such blank forms and in such manner as may be specified by the Chief of the Bureau of Animal Industry.

SECTION 2. The proprietors of official establishments shall furnish daily to the Department employees detailed to the various departments accurate information regarding receipts, shipments, and amounts of products on which to base their daily reports.

SECTION 3. Reports on sanitation shall be made at stated times by the Department employees in charge of the various departments to the inspector in charge of the station, and by the inspector in charge to the Chief of the Bureau of Animal Industry. If any insanitary conditions are detected by any Department employee, such conditions shall be reported immediately to the inspector in charge, who, after investigation, shall report them to the Chief of the Bureau.

REGULATION 28. APPEALS.

SECTION 1. When the action of any inspector in condemning any carcass or part thereof, meat, or meat food product is questioned, appeal may be made to the inspector in charge, and from his decision appeal may be made to the Chief of the Bureau of Animal Industry or to the Secretary of Agriculture, whose decision shall be final.

REGULATION 29. COOPERATION WITH MUNICIPAL AUTHORITIES.

SECTION 1. Inspectors in charge are directed to notify the municipal authorities of the character of inspection, and upon request to advise with such authorities with a view to preventing the entry into the local markets of diseased animals or their products. The details of any proposed cooperative arrangement must be first submitted to and approved by the Chief of the Bureau of Animal Industry.

AMENDMENT 1 TO B. A. I. ORDER 150.

Regulations Governing the Meat Inspection of the United States Department of Agriculture—Amendment to Section 19 of Regulation 25, Exempting Shipments of Certain Inedible Grease, Tallow, or Other Fat from the Provision Requiring the Denaturing of Inedible Products.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., April 24, 1908.

For the purpose of preventing the use in interstate or foreign commerce of meat and meat food products which are unsound, unhealthful, unwholesome, or otherwise unfit for human food, under authority conferred upon the Secretary of Agriculture by the provisions of the act of Congress approved June 30, 1906 (34 Stat., 674), the following paragraph, numbered paragraph 6, is hereby prescribed as an addition to section 19 of Regulation 25.

This amendment, which for the purpose of identification is designated as Amendment 1 to B. A. I. Order 150, shall become and be effective on and after May 1, 1908.

JAMES WILSON, *Secretary of Agriculture.*

Paragraph 6. When inedible grease, tallow, or other fat for industrial use is of such a nature or is intended for such an industrial use that it is impracticable to denature the same or that denaturing will make it impossible to put the product to the desired industrial use, such inedible grease, tallow, or other fat may be shipped from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia, or to a foreign country, without denaturing if the outside container of the said inedible grease, tallow, or other fat be marked as follows: The end of the containers shall be painted white and conspicuously stenciled or burned with the true name of the product and the word "INEDIBLE."

No such shipment shall be accepted by any carrier unless and until the shipper shall certify in writing that the said inedible grease, tallow, or other fat is of such a character or is intended for such use that denaturing is impossible or will render said inedible grease, tallow, or other fat unavailable for the desired industrial use.

The shipper's certificate shall be in the following form:

Date________________________, 190___

INEDIBLE FAT.

Name of common carrier____
Consignor____
Point of shipment____
Consignee____
Destination____

I hereby certify that the following-described fat is inedible and is not intended for food purposes, and that the said fat is of such a character or is intended for such a use that denaturing is impossible or will render said fat unavailable for the desired industrial use.

Kind of product.	Amount and weight.
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________

____
(Signature of shipper.)

____
(Business or occupation of shipper.)

____
(Address of shipper.)

As evidence to connecting carriers that the proper shipper's certificate is on file with the initial carrier, the waybills, transfer bills, running slips, or conductors' cards accompanying such shipments must have embodied in, stamped upon, or attached to the same a signed statement in the following form:

(Name of carrier)___________________________
Inedible and not intended for food purposes, as evidenced by shipper's certificate on file with the initial carrier.
(Signed) ______________________ *Agent.*

The shipper's certificate shall be made in duplicate, and one copy shall be immediately forwarded by the carrier to the Chief of the Bureau of Animal Industry, Washington, D. C.

MEAT INSPECTION RULINGS—3A.

Notice Regarding the Enforcement of that Portion of Paragraph 5 of Section 19 of Regulation 25 of B. A. I. Order 150, Relating to the Denaturing of Inedible Grease, Tallow, and Other Fat.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., April 6, 1908.

Notice is hereby given that that portion of paragraph 5 of section 19 of Regulation 25 of Bureau of Animal Industry Order 150, which requires that no shipment of inedible grease or tallow or other fat shall be shipped or accepted for shipment from one State or Territory or the District of Columbia to another State or Territory or the District of Columbia, or to a foreign country, unless and until such shipment has been denatured or otherwise rendered unavailable for food purposes and a certificate to that effect has been filed with the transportation company, will not be enforced until May 1, 1908.

W. M. HAYS, *Acting Secretary.*

B. A. I. ORDER 151.

Rule 1, Revision 3.—To Prevent the Spread of Splentic Fever in Cattle (Effective on and after April 1, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious and infectious disease known as splenetic, southern, or Texas fever exists among cattle in the following-named States and Territories, to wit:

CALIFORNIA, OKLAHOMA, TEXAS, MISSOURI, ARKANSAS, LOUISIANA, MISSISSIPPI, TENNESSEE, ALABAMA, VIRGINIA, NORTH CAROLINA, SOUTH CAROLINA, GEORGIA, and FLORIDA.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 1264), do hereby quarantine the area hereinafter described and do order by this Rule 1, Revision 3, under the authority and discretion conferred on the Secretary of Agriculture by section 3 of the act of Congress approved March 3, 1905 (33 Stat., 1265), that the interstate movement of cattle of the area herein quarantined to any point not located in the said quarantined area shall be made only in accordance with the regulations of the Secretary of Agriculture designated as B. A. I. Order 143, promulgated March 22, 1907, and effective April 15, 1907, and amendments thereto, subject only to the exceptions hereinafter contained.

The following areas are quarantined for splenetic, southern, or Texas fever in cattle:

CALIFORNIA.

The counties of San Diego, Imperial, Orange, Riverside, Los Angeles, Ventura, San Luis Obispo, that portion of San Bernardino County west of the one hundred and sixteenth meridian west longitude, Santa Barbara County with the exception of the island of Santa Rosa, and that portion of Fresno County west of the right of way of the main line of the Southern Pacific Company are quarantined.

During the continuance of this quarantine no cattle of the counties of Riverside, Los Angeles, Ventura, San Luis Obispo, Santa Barbara (except the island of Santa Rosa), that portion of San Bernardino County west of the one hundred and sixteenth meridian west longitude, or that portion of Fresno County west of the right of way of the main line of the Southern Pacific Company shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of California which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the movement issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in California which are quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

TEXAS.

The entire State of Texas is quarantined, with the exception of the counties of Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hartley, Moore, Hutchinson, Roberts, Hemphill, Oldham, Potter, Carson, Gray, Wheeler, Deaf Smith, Randall, Armstrong, Donley, Collingsworth, Parmer, Castro, Swisher, Briscoe, Hall, Childress, Bailey, Lamb, Hale, Floyd, Motley, Cochran, Hockley, Lubbock, Crosby, Dickens, Yoakum, Terry, Lynn, Garza, Kent, Gaines, Dawson, Andrews, Martin, El Paso, Jeff Davis, Presidio, Brewster, Reeves, Loving, Winkler, Ector, Midland, and Ward.

During the continuance of this quarantine no cattle of the counties of Cottle, Hardeman, Foard, Wilbarger, King, Knox, Baylor, Stonewall, Haskell, Borden, Scurry, Fisher, Jones, Howard, Mitchell, Glasscock, Sterling, Crane, Upton, Reagan, Irion, those portions of the counties of Pecos and Terrell north and west of a line beginning at a point on the western boundary of Pecos County where said boundary is intersected by the roadbed of the Galveston, Harrisburg and San Antonio Railroad Company; thence in an easterly direction with the center of said roadbed to a point on section No. 36, block A2, Galveston, Harrisburg and San Antonio Railroad Company; thence north with the pasture fence, running in a northerly direction through the eastern part of sections Nos. 13 and 12 of said block A2 and across section 1, Gulf, Colorado and Santa Fe Railway Company; thence continuing north with said pasture fence through the eastern parts of sections Nos. 16, 17, 46, 47, 76, 77, 106, 107, 136, 137, 142, 143, and 194, block D, Missouri, Kansas and Texas Extension Railway Company; thence continuing in a

northerly direction to a point on the northern boundary of section No. 6, block 160, Gulf, Colorado and Santa Fe Railway Company, same being corner of pasture fence; thence east along the northern boundary of sections Nos. 6, 9, 10, 11, 12, 15, 16, block 160, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of said section No. 16, the same being corner of pasture fence; thence in a northerly direction with the eastern boundary of sections Nos. 22, 21, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31, and 32, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 32; thence west with the northern boundary of sections Nos. 32 and 33, same block, to the northwest corner of section No. 33, block 1, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, corner of fence; thence north with the eastern boundary of sections Nos. 1, 12, 13, 24, 25, 36, 37, 48, 49, 60, 61, and 72, block 2, Corpus Christi, San Diego and Rio Grande Narrow Gauge Railway Company, to the northeast corner of said section No. 72; thence in an easterly direction with the pasture fence to the southeast corner of section No 9, patented to James E. Evans; thence north along the eastern boundary of said section No. 9 to the northwest corner of section No. 100, block A2, Texas Central Railway Company; thence east with the northern boundary of sections Nos. 100 and 89, same block, to the northeast corner of said section No. 89, block A2, Texas Central Railway Company; thence north along the eastern boundary of sections Nos. 90, 91, 92, and 93 to the southeast corner of section No. 94, block A2, Texas Central Railway Company; thence northwest diagonally across section No. 94 to the northwest corner of said section; thence continuing in a northwesterly direction diagonally across sections Nos. 14, 18, and 28 to the northeast corner of section No. 29, block C4, Gulf, Colorado and Santa Fe Railway Company; thence west with the northern boundary of said section No. 29 to the northwest corner of said section; thence northwest diagonally across section No. 1, Texas Central Railway Company, section No. 97, block 194, Gulf, Colorado and Santa Fe Railway Company, to the northeast corner of section No. 96; thence in a northerly direction across section No. 94 to a point on its northern boundary 600 varas west of its northeast corner; thence continuing north through sections Nos. 93, 90, 89, 86, 85, and 58, block 194, Gulf, Colorado and Santa Fe Railway Company, to a point on the northern boundary of said section No. 58; thence northwesterly with the pasture fence through section No. 59 to the northeast corner of section No. 82 and the southeast corner of section No. 81, same block; thence continuing northwesterly to section No. 17, Houston and Great Northern Railroad Company; thence north along the eastern boundary of said section No. 17 to the Pecos River; thence northwesterly along said Pecos River to the northwest corner of Crockett County, or that portion of Tom Green County west of a line extending due north from the northeast corner of Irion County to the southern boundary of Coke County, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Texas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of Texas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

OKLAHOMA.

The entire State of Oklahoma is quarantined except the counties of Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Grant, Kay, Woodward, Major, Garfield, Ellis, Dewey, Kingfisher, Logan, Roger Mills, Custer, Beckham, Washita, Oklahoma, that portion of Blaine County north of the Canadian River, that portion of Canadian County north of the Canadian River, that portion of Cleveland County north of the Canadian River and west of the Atchison, Topeka and Santa Fe Railway, and that portion of Noble County west of the Atchison, Topeka and Santa Fe Railway and north of the line between townships 23 and 24 north.

During the continuance of this quarantine no cattle of Greer County, that portion of Cleveland County east of the Atchison, Topeka and Santa Fe Railway and north of the line between townships 7 and 8 north, or that portion of Noble County east of the Atchison, Topeka, and Santa Fe Railway and south of the line between townships 21 and 22 north, or of the Kansas Nation or Osage Nation, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Oklahoma which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the

movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of Oklahoma which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

During the continuance of this quarantine no cattle of the quarantined area of any State or Territory other than the State of Oklahoma shall, except as hereinafter provided, be moved or allowed to move into the Kansas Nation or Osage Nation: *Provided,* That from October 1 of each year to May 15 of the following year cattle of the quarantined area of any other State or Territory may be moved into the above-mentioned nations after having been satisfactorily dipped in Beaumont crude petroleum, or otherwise properly treated, under the supervision of an inspector of the Bureau of Animal Industry.

MISSOURI.

Ripley County, that portion of Oregon County south of the line between townships 22 and 23 north, that portion of Newton County west of the right of way of the Kansas City Southern Railway, and that portion of McDonald County west of the right of way of the Kansas City Southern Railway are quarantined.

During the continuance of this quarantine no cattle of the area hereinbefore described shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Missouri which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

ARKANSAS.

The entire State of Arkansas is quarantined except the counties of Carroll, Randolph, Clay, Greene, and Lawrence.

During the continuance of this quarantine no cattle of Benton County shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Arkansas which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in that portion of the State of Arkansas which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

TENNESSEE.

The following-mentioned counties and parts of counties are quarantined: The counties of Shelby, Hardeman, McNairy, Chester, Henderson, Decatur, Hardin, Wayne, Lawrence, Marion, Hamilton, James, Bradley, Polk, Warren, Overton, Pickett; that portion of Madison County east and south of a line beginning at a point on the southern boundary line of Madison County where the Illinois Central Railroad intersects said line; thence northerly along the Illinois Central Railroad to the corporate limits of the city of Jackson; thence westerly and northerly along the corporate limits of the city of Jackson to the Jackson and Spring Creek public road; thence northerly along the Jackson and Spring Creek public road to its intersection with the southern boundary of Carroll County; that portion of Benton County south of the Louisville and Nashville Railroad; those portions of the counties of Giles, Lincoln, and Franklin south of Elk River; that portion of Sequatchie County east of the western bluff or crest of Waldens Ridge; that portion of Dekalb County south and east of a line beginning at the intersection of the northeastern corner of Cannon County with the west prong of Dry Creek near the southeast corner of the third civil district of Dekalb County; thence northerly along said creek to its intersection with the southerly boundary of the twentieth civil district of said county; thence easterly and northerly along the southern and eastern boundaries of said twentieth civil district to the southern boundary of the tenth civil district of said county near Capling; thence southeasterly along the southern boundary of the tenth and twenty-second civil districts of said county to Big Hurricane (or Hurricane) Creek; thence northerly along said creek to Caney Fork River; thence northwesterly along Caney Fork River to the eastern boundary of the eighteenth civil district

of said Dekalb County; thence northerly along the eastern boundary of said eighteenth civil district to the southern boundary of Putnam County; that portion of Putnam County not included in the ninth, tenth, and eleventh civil districts; that portion of Fentress County west of the East Fork Obey River, and that portion of White County north and west of a line beginning on the southern boundary of White County where the Calf Killer River empties into Caney Fork River; thence northerly along Caney Fork River to the Nashville, Chattanooga and St. Louis Railway; thence northeasterly along the Nashville, Chattanooga and St. Louis Railway to the western bluff of Cumberland Mountain, near Bon Air; thence continuing northeasterly along the bluff of Cumberland Mountain to the Putnam County line near Ravenscroft.

During the continuance of this quarantine no cattle of the counties of Warren, Overton, Pickett, or those portions of the counties of Dekalb, Putnam, Fentress, and White, above described, shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Tennessee which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties and portions of counties in that part of the State of Tennessee which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

GEORGIA.

The entire State of Georgia is quarantined except the counties of Union, Towns, and Rabun.

During the continuance of this quarantine no cattle of the counties of Fannin, Murray, Gilmer, White, Habersham, Stephens, or Hall shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Georgia which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in that part of the State of Georgia which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

SOUTH CAROLINA.

The entire State of South Carolina is quarantined.

During the continuance of this quarantine no cattle of the counties of Oconee, Pickens, Greenville, or Anderson shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of South Carolina which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in the State of South Carolina cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

NORTH CAROLINA.

The counties of Warren, Franklin, Wake, Chatham, Randolph, Stanley, Union, Anson, Montgomery, Moore, Harnett, Johnston, Wilson, Nash, Halifax, Northampton, Hertford, Bertie, Gates, Chowan, Perquimans, Pasquotank, Camden, Currituck, Edgecombe, Martin, Washington, Tyrrell, Dare, Hyde, Beaufort, Pitt, Wayne, Sampson, Cumberland, Richmond, Scotland, Robeson, Bladen, Greene, Lenoir, Craven, Pamlico, Carteret, Jones, Duplin, Onslow, Pender, Columbus, Brunswick, and New Hanover are quarantined.

From the counties above mentioned cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

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VIRGINIA.

The counties of Fluvanna, Chesterfield, York, Pittsylvania, Mecklenburg, Lunenburg, Brunswick, Greenesville, Sussex, Surry, Southampton, Isle of Wight, and Nansemond are quarantined.

During the continuance of this quarantine no cattle of Fluvanna County shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Virginia which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other counties in that portion of the State of Virginia which is quarantined for splenetic, southern, or Texas fever, cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

LOUISIANA.

The entire State of Louisiana is quarantined.

During the continuance of this quarantine no cattle of the parishes of Lincoln and Claiborne shall be moved or allowed to move, except as provided for immediate slaughter, to any point in the United States not in the State of Louisiana which is located in an area not quarantined for splenetic, southern, or Texas fever unless and until the said cattle shall have been inspected and found free of infection and a written permit for the shipment issued by an inspector of the Bureau of Animal Industry, nor until permission shall have been obtained in advance of the movement from the proper official of the State or Territory into which the cattle are to be shipped.

From the other parishes in the State of Louisiana cattle shall only be moved or allowed to move interstate to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

MISSISSIPPI, ALABAMA, FLORIDA.

The entire States of Mississippi, Alabama, and Florida are quarantined.

From the above-mentioned States cattle shall only be moved or allowed to move to points outside of the quarantined area in accordance with the regulations for immediate slaughter.

GENERAL PROVISION.

During the continuance of the quarantine as herein established no cattle of the quarantined area of any State or Territory (except those portions from which cattle may be moved upon inspection) shall be moved or allowed to move to any portion of the quarantined area of another State or Territory from which, under the specific provisions of this rule, cattle are allowed to be shipped for purposes other than immediate slaughter upon inspection and certification by an inspector of the Bureau of Animal Industry.

OPEN SEASON.

During the months of January, November, and December of each year cattle of the quarantined area of any State or Territory may be moved interstate therefrom for purposes other than immediate slaughter into the State of Kansas, the Territories of Arizona and New Mexico, those portions of the States of California, Texas, Tennessee, and Georgia not included in the quarantined area, and that portion of the State of Missouri south of the Missouri River if the said cattle shall first have been inspected under proper facilities for inspection at the point of origin and found free of infection and a written permit for the movement issued by an inspector of the Bureau of Animal Industry or by a duly authorized inspector of the State or Territory to which the cattle are destined, and if permission shall first have been obtained from the proper official of the said State or Territory. During the months of January and February, the first fifteen days of March and the last sixteen days of December in each year, cattle of the quarantined area of any State or Territory may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into those portions of the States of Virginia and North Carolina not included in the quarantined area. During the month of January and the last seventeen days of December in each year cattle of the quarantined area of any State or Territory may be moved interstate therefrom for purposes other than immediate slaughter under the above-mentioned restrictions into that portion of the State of Oklahoma not included in the quarantined area.

Cattle of the quarantined area that have been shipped interstate during the months of January, November, and December of each year to any State or Territory outside of the quarantined area other than those States and Territories and portions thereof set out herein shall not be moved into any of the States or Territories or portions thereof

hereinbefore mentioned within three months of the date of the movement from the quarantined area.

Cattle which are moved interstate from the quarantined area of any State or Territory into those States or Territories or portions thereof hereinbefore mentioned, under certificates from inspectors either of the Bureau of Animal Industry or of the States or Territories to which the cattle are destined for feeding or stocking purposes shall, when shipped, be transported in cleaned and disinfected cars or boats and shall not be placed in stock pens which have been reserved for cattle originating in the quarantined area.

FEEDING STATIONS FOR NONINFECTED CATTLE.

Cattle not of the quarantined area which are transported interstate by rail through the quarantined area may be unloaded therein for rest, feed, and water into properly equipped noninfectious pens set apart for such cattle at the Fort Worth Stock Yards at Fort Worth, Tex.; the stock yards of the Missouri, Kansas and Texas Railway at Hodge, Tex.; the stock yards of the International and Great Northern Railroad at Laredo, Tex.; the Southern Pacific Railway Stock Yards at Los Angeles, Cal.; the stock yards of Colton, Cal., and Bakersfield, Cal.; the Sapulpa Stock Yards of the St. Louis and San Francisco Railroad at Sapulpa, Okla.; the stock yards of the Missouri, Kansas and Texas Railway at Muskogee, Okla.; and at such other points as may from time to time be authorized by the Secretary of Agriculture, provided such pens and the platforms, chutes, and alleyways leading thereto are constructed and maintained in accordance with the specifications set out in the regulations of the Secretary of Agrciulture to prevent the spread of splenetic fever in cattle.

All cattle handled in such noninfectious pens shall be free from ticks (*Margaropus annulatus*) and shall not have been unloaded at any point in the quarantined area other than the designated unloading points named herein or hereafter authorized by the Secretary of Agriculture, and they shall be reloaded into the same cars from which unloaded or into other cars which have been cleansed, washed, and disinfected as specified in Regulation 14 of B. A. I. Order 143, immediately before loading therein, and reshipped as uninfected cattle.

INTERPRETATION.

This Rule 1, Revision 3, shall be construed in connection with the regulations of the Secretary of Agriculture promulgated March 22, 1907, and effective on and after April 15, 1907, and amendments thereto, and is subject to amendment or revision on statutory notice.

Rule 1, Revision 2, dated March 22, 1907, effective April 15, 1907, and all amendments thereto, shall cease to be effective on and after April 1, 1908, on and after which date this Rule 1, Revision 3, which for purposes of identification is designated as B. A. I. Order 151, shall become and be effective until otherwise ordered.

Done at Washington this seventeenth day of March, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 151.

Amendment 1 to Rule 1, Revision 3.—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding Cattle for the Oklahoma State Fair.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is hereby ordered that the provisions of Rule 1, Revision 3 (B. A. I. Order 151), dated March 17, 1908, and effective on and after April 1, 1908, under which cattle of the area quarantined for Texas or splenetic fever are only permitted to be shipped interstate to points outside the quarantined area for immediate slaughter, be, and the same are hereby, suspended in so far as they may apply to cattle intended for exhibition or sale purposes at the Oklahoma State Fair to be held at Oklahoma City, Okla., October 1 to October 10, 1908, inclusive.

Provided, That all such cattle shall be free from ticks (*Margaropus annulatus*) at time of shipment from points of origin; that they shall be transported in cleaned and disinfected cars; that they shall be consigned "Care State Fair Association of Oklahoma;" that while outside of the quarantined area they shall be yarded and otherwise handled in the manner prescribed by Regulation 14 as contained in Amendment 3 to B. A. I. Order 143, and that at the close of the fair all such cattle shall be either returned to the quarantined area, shipped as "southern cattle" for immediate slaughter, or dipped in accordance with Regulation 17, as contained in Amendment 3 to B. A. I. Order 143.

It is further provided, That at the close of the fair the premises occupied by said cattle during the fair, and the chutes, etc., through which they were handled shall be cleaned and disinfected in the manner prescribed by Regulation 14 above referred to, and that no hay, straw, or litter shall be removed from said premises without disinfection.

Done at Washington this twenty-fourth day of August, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] W. M. HAYS, *Acting Secretary.*

AMENDMENT 2 TO B. A. I. ORDER 151.

Amendment 2 to Rule 1, Revision 3.—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding the Return of Cattle of the Nonquarantined Area that are Exhibited at the Georgia State Fair at Atlanta, Ga., October 8 to 24, 1908.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 1, Revision 3, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1908, which relates to the quarantine in the State of Georgia, is hereby modified to permit the interstate shipment to points outside the quarantined area as uninfected cattle of cattle of the nonquarantined area that are exhibited by the Georgia State Fair, to be held at Atlanta, Ga., October 8 to October 24, 1908, subject to the following restrictions:

(*a*) Such cattle shall be shipped by rail to Atlanta and shall not be unloaded in the quarantined area elsewhere than at Atlanta.

(*b*) Separate cleaned and disinfected chutes and other facilities shall be provided for the exclusive unloading and loading of such cattle at Atlanta.

(*c*) Such cattle shall be hauled in cleaned and disinfected wagons direct from the cars in which they arrive at Atlanta to the fair grounds, and from the fair grounds direct to the cars in which they are to be reshipped.

(*d*) That portion of the fair grounds and other premises to be occupied by such cattle shall have been inaccessible to other cattle for at least six months previous to the date of the opening of the fair.

(*e*) The hay, straw, or similar materials required for food and bedding by such cattle during the time they are within the quarantined area shall be shipped in cleaned and disinfected cars from points outside of the quarantined area and so handled at Atlanta that it may not become infectious.

(*f*) Such cattle shall not be returned from Atlanta to points outside of the quarantined area except in cleaned and disinfected cars, nor unless accompanied by a certificate issued by an inspector of the Bureau of Animal Industry, showing that such cattle have had no opportunity to become infected with the cattle tick (*Margaropus annulatus*).

Done at Washington this first day of September, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 3 TO B. A. I. ORDER 151.

Amendment 3 to Rule 1, Revision 3.—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding the Return of Cattle of the Nonquarantined Area that are Exhibited at the Tri-State Fair at Memphis, Tenn., September 28 to October 7, 1908.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 1, Revision 3, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1908, which relates to the quarantine in the State of Tennessee, is hereby modified to permit the interstate shipment to points outside the quarantined area as uninfected cattle of cattle of the nonquarantined area that are exhibited at the Tri-State Fair, to be held at Memphis, Tenn., September 28 to October 7, 1908, subject to the following restrictions:

(*a*) Such cattle shall be shipped by rail to Memphis and shall not be unloaded in the quarantined area elsewhere than at Memphis.

(*b*) Separate cleaned and disinfected chutes and other facilities shall be provided for the exclusive unloading and loading of such cattle at Memphis.

(*c*) Such cattle shall be hauled in cleaned and disinfected wagons direct from the cars in which they arrive at Memphis to the fair grounds, and from the fair grounds direct to the cars in which they are to be reshipped.

(*d*) That portion of the fair grounds and other premises to be occupied by such cattle shall have been inaccessible to other cattle for at least six months previous to the date of the opening of the fair.

(*e*) The hay, straw, or similar materials required for food and bedding by such cattle during the time they are within the quarantined area shall be shipped in cleaned and disinfected cars from points outside of the quarantined area and so handled at Memphis that it may not become infectious.

(*f*) Such cattle shall not be returned from Memphis to points outside of the quarantined area except in cleaned and disinfected cars, nor unless accompanied by a certificate issued by an inspector of the Bureau of Animal Industry, showing that such cattle have had no opportunity to become infected with the cattle tick (*Margaropus annulatus*).

Done at Washington this twenty-sixth day of September, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 4 TO B. A. I. ORDER 151.

Amendment 4 to Rule 1, Revision 3.—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Regarding the Return of Cattle of the Nonquarantined Area that are Exhibited at the North Carolina State Fair at Raleigh, N. C., October 12 to 17, 1908.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 1, Revision 3, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1908, which relates to the quarantine in the State of North Carolina, is hereby modified to permit the interstate shipment to points outside the quarantined area as uninfected cattle of cattle of the nonquarantined area that are exhibited at the North Carolina State Fair, to be held at Raleigh, N. C., October 12 to October 17, 1908, subject to the following restrictions:

(*a*) Such cattle shall be shipped by rail to Raleigh and shall not be unloaded in the quarantined area elsewhere than at Raleigh.

(*b*) Separate cleaned and disinfected chutes and other facilities shall be provided for the exclusive unloading and loading of such cattle at Raleigh.

(*c*) Such cattle shall be hauled in clean and disinfected wagons direct from the cars in which they arrive at Raleigh to the fair grounds, and from the fair grounds direct to the cars in which they are to be reshipped.

(*d*) That portion of the fair grounds and other premises to be occupied by such cattle shall have been inaccessible to other cattle for at least six months previous to the date of the opening of the fair.

(*e*) The hay, straw, or similar material required for feed and bedding by such cattle during the time they are within the quarantined area shall be shipped in cleaned and disinfected cars from points outside of the quarantined area and so handled at Raleigh that it may not become infectious.

(*f*) Such cattle shall not be returned from Raleigh to points outside of the quarantined area except in cleaned and disinfected cars, nor unless accompanied by a certificate issued by an inspector of the Bureau of Animal Industry, showing that such cattle have had no opportunity to become infected with the cattle tick (*Margaropus annulatus*).

Done at Washington this ninth day of October, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] W. M. HAYS, *Acting Secretary of Agriculture.*

AMENDMENT 5 TO B. A. I. ORDER 151.

Amendment 5 to Rule 1, Revision 3.—To Prevent the Spread of Splenetic Fever in Cattle. Amendment Covering Changes in Feeding Stations for Noninfected Cattle (Effective on and after December 15, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

It is ordered that that portion of Rule 1, Revision 3, to prevent the spread of splenetic fever in cattle, effective on and after April 1, 1908, which relates to "Feeding Stations for Noninfected Cattle," is hereby amended to read as follows:

"Cattle not of the quarantined area which are transported interstate by rail through the quarantined area may be unloaded therein for rest, feed, and water into properly

equipped noninfectious pens set apart for such cattle at the Fort Worth Stock Yards at Fort Worth, Tex.; the stock yards of the Missouri, Kansas and Texas Railway at Hodge and Denison, Tex.; the stock yards of the International and Great Northern Railroad at Laredo, Tex.; the Southern Pacific Railway stock yards at Los Angeles, Cal.; the stock yards at Colton, Cal.; the stock yards of the St. Louis and San Francisco Railroad at Sapulpa, Okla.; the stock yards of the Missouri, Kansas and Texas Railway at Muskogee, Okla.; and at such other points as may from time to time be authorized by the Secretary of Agriculture, provided such pens and the platforms, chutes, and alleyways leading thereto are constructed and maintained in accordance with the specifications set out in the regulations of the Secretary of Agriculture to prevent the spread of splenetic fever in cattle.

"All cattle handled in such noninfectious pens shall be free from ticks (*Margaropus annulatus*) and shall not have been unloaded at any point in the quarantined area other than the designated unloading points named herein or hereafter authorized by the Secretary of Agriculture, and they shall be reloaded into the same cars from which unloaded or into other cars which have been cleaned, washed, and disinfected as specified in Regulation 14 of Bureau of Animal Industry Order 143 and amendments thereto, immediately before loading therein, and reshipped as uninfected cattle."

This amendment shall become and be effective on and after December 15, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this third day of December, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 152.

Rule 2, Revision 2.—To Prevent the Spread of Scabies in Cattle (Effective on and after October 1, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease known as scabies exists among cattle in the following-named States and Territory, to wit:

MONTANA, NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, KANSAS, WYOMING, COLORADO, OKLAHOMA, TEXAS, and NEW MEXICO.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following territory, to wit:

The counties of Teton, Chouteau, Valley, and Dawson, in the State of MONTANA; that part of the State of NORTH DAKOTA lying south and west of the Missouri River; that part of the State of SOUTH DAKOTA lying west of the Missouri River; the counties of Sioux, Scotts Bluff, Banner, Kimball, Cheyenne, Boxbutte, Dawes, Sheridan, Deuel, Dundy, Chase, Perkins, Keith, McPherson, Grant, Cherry, Hooker, Thomas, Logan, Lincoln, Hayes, Hitchcock, Dawson, Custer, Blaine, Brown, Keyapaha, Rock, Loup, Garfield, Wheeler, Holt, and Boyd, in the State of NEBRASKA; the counties of Cheyenne, Sherman, Wallace, Greeley, Hamilton, Stanton, Morton, Stevens, Grant, Kearny, Wichita, Logan, Thomas, Rawling, Decatur, Sheridan, Gove, Scott, Lane, Fenney, Gray, Haskell, Seward, Meade, Clark, Ford, Hodgeman, Ness, Trego, Ellis, Rush, Pawnee, Edwards, Kiowa, and Comanche, in the State of KANSAS; the counties of Natrona, Converse, Carbon, Albany, and Laramie, in the State of WYOMING; the counties of Weld, Logan, Sedgwick, Phillips, Yuma, Washington, Morgan, Adams, Elbert, Lincoln, Kit Carson, Cheyenne, Kiowa, Prowers, Baca, Bent, Otero, that part of the counties of El Paso, Pueblo, Huerfano, and Las Animas lying east of the Eighth Guide Meridian West, and that part of Arapahoe County lying east of a line extending from the southeastern corner of Denver County due south to the northern boundary of Douglas County, in the State of COLORADO; the counties of Cimarron, Texas, Beaver, and Harper, in the State of OKLAHOMA; the counties of Dallam, Sherman, Hansford, Ochiltree, Lipscomb, Hemphill, Roberts, Hutchinson, Moore, Hartley, Oldham, Potter, Carson, Gray, Wheeler, Collingsworth, Donley, Armstrong, Randell, Deaf Smith, Parmer, Castro, Swisher, Briscoe, Hall, Childress, Cottle, Motley, Floyd, Hale, Lamb, Bailey, Cochran, Hockley, Lubbock, Crosby, Dickens, King, Stonewall, Kent, Garza, Lynn, Terry, Yoakum, Gaines, Dawson, Borden, Scurry, Fisher, Nolan, Mitchell, Howard, Martin, Andrews, Neuces, Cameron, Hidalgo, and that part of Knox, Haskell, Jones, and Taylor lying west of the 100th meridian of longitude west of Greenwich, in the State of TEXAS; the counties of Colfax, Mora, San Miguel, Union, Guadalupe, Quay, Roosevelt, Chaves, Eddy; that portion

of Torrance County lying east and south of the El Paso and Rock Island Railway; that portion of Lincoln County lying east and south of the El Paso and Northeastern and the El Paso and Rock Island railways, and that portion of Otero County lying east of the El Paso and Northeastern Railway, in the Territory of NEW MEXICO.

The effect of this order is to release from quarantine the counties of Williams, Ward, McLean, Wells, Eddy, Foster, Stutsman, Kidder, Burleigh, Emmons, Logan, and McIntosh, in the State of North Dakota, a portion of what was formerly Woodward County of the Territory of Oklahoma, and the counties of Boulder, Jefferson, Denver, Douglas, Teller, Custer, the remainder of Larimer and Fremont counties, a small portion of Arapahoe County, and those portions of El Paso, Pueblo, Huerfano, and Las Animas counties lying west of the Eighth Guide Meridian West, in the State of Colorado.

It is ordered by this Rule 2, Revision 2, under the authority and discretion conferred upon the Secretary of Agriculture by section 3 of the act of Congress approved March 3, 1905 (33 Stat., 864), that cattle shall be moved from the quarantined area of any State or Territory to any other State or Territory or District only in accordance with the regulations of the Secretary of Agriculture designated as B. A. I. Order 143, promulgated March 22, 1907, and effective April 15, 1907.

This Rule 2, Revision 2, is subject to amendment or revision on statutory notice.

Rule 2, Revision 1, dated March 22, 1907, and effective April 15, 1907, and its amendments dated February 11, 1908, and April 1, 1908, respectively, shall cease to be effective on and after October 1, 1908, on and after which date this Rule 2, Revision 2, which for purposes of identification is designated as B. A. I. Order 152, shall become and be effective until otherwise ordered.

Done at Washington this fifth day of September, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 152.

Amendment 1 to Rule 2, Revision 2.—To Prevent the Spread of Scabies in Cattle (Amendment effective on and after October 15, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that the contagious disease known as scabies is not now known to exist, or exists to a slight extent only, among cattle in the counties of Colfax, Mora, and San Miguel, in the Territory of New Mexico, and in the counties of Edwards, Pawnee, Hodgeman, Ness, Rush, Ellis, and Decatur, in the State of Kansas, quarantined by Rule 2, Revision 2, dated September 5, 1908, and effective October 1, 1908.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority of law, do hereby amend said Rule 2, Revision 2, to prevent the spread of scabies in cattle, in the following particulars, to wit:

That part of said rule which specifies the quarantined portion of the Territory of New Mexico is amended to read as follows:

"The counties of Union, Guadalupe, Quay, Roosevelt, Chaves, Eddy, that portion of Torrance County lying east and south of the El Paso and Rock Island Railway, that portion of Lincoln County lying east and south of the El Paso and Northeastern and the El Paso and Rock Island railways, and that portion of Otero County lying east of the El Paso and Northeastern Railway, in the Territory of New Mexico."

That part of said rule which specifies the quarantined portion of the State of Kansas is amended to read as follows:

"The counties of Cheyenne, Sherman, Wallace, Greeley, Hamilton, Stanton, Morton, Stevens, Grant, Kearney, Wichita, Logan, Thomas, Rawlins, Sheridan, Gove, Scott, Lane, Finney, Gray, Haskell, Seward, Meade, Clark, Ford, Trego, Kiowa, and Comanche, in the State of Kansas."

The effect of this order is to release from quarantine on account of scabies in cattle the counties of Colfax, Mora, and San Miguel, in the Territory of New Mexico, and the counties of Edwards, Pawnee, Hodgeman, Ness, Rush, Ellis, and Decatur, in the State of Kansas.

Done at Washington this twenty-third day of September, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER NO. 153.

Special Order Providing for the Importation of Canadian Cattle for Exhibition Purposes at the Vermont State Fair, White River Junction, Vt.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 2, 1908.

It is hereby ordered, That Canadian cattle may be imported into the United States for exhibition purposes at the Vermont State Fair, to be held at White River Junction, Vt., from September 22 to September 25, 1908, provided such cattle pass a satisfactory inspection at the port of entry, and are accompanied by a satisfactory certificate of tuberculin test made not more than six (6) months previously, and an affidavit by the owner or importer, stating that the said certificate of tuberculin test refers to the cattle in question, and provided further that any such cattle which are not sold to remain in the United States shall be returned immediately to Canada at the close of the exhibition.

The Department must be notified of any Canadian cattle which will remain in the United States, not tested as required by Regulation 37 of Bureau of Animal Industry Order 142, Regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants, and swine imported into the United States, and the tuberculin test will be applied to them by an inspector of this Department before shipment to destination.

All Canadian cattle intended for this fair must be shipped directly to the fair grounds, and must not be unloaded in any public stock yards.

JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER NO. 154.

Special Order Providing for the Importation of Canadian Sheep for Exhibition Purposes at the International Live Stock Exposition, Chicago, Ill.

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY,
Washington, D. C., September 2, 1908.

It is hereby ordered, That from November 20 to December 5, 1908, Canadian sheep may be imported into the United States for exhibition purposes at the International Live Stock Exposition, to be held at Chicago, Ill., from November 28 to December 10, 1908, without being subject to the thirty days' quarantine, provided they pass a satisfactory inspection at the port of entry and are accompanied by an affidavit of the owner or importer, and a certificate issued by a Canadian official veterinarian, as required by Amendment 3 to B. A. I. Order 142, amending Regulation 41 of the Regulations for the inspection and quarantine of horses, cattle, sheep, and other ruminants and swine imported into the United States, and provided further that the sheep which are not sold to remain in the United States shall be returned immediately to Canada at the close of said exposition.

The Department must be notified by the owner or importer, through the office of its veterinary inspector in charge at Chicago, of any Canadian sheep which are to remain in the United States for breeding purposes, and such sheep will be maintained in quarantine at the exposition grounds under the supervision of an inspector of this Department, who shall issue a certificate before shipment to destination is allowed.

The thirty days of quarantine will be counted from the date of entry into the United States.

All Canadian sheep intended for this exposition must be shipped directly to the exposition grounds, and must not be unloaded in any public stock yards.

JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER NO. 155.

Rule 6.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, Swine, and Goats (Effective on and after November 13, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease, known as foot-and-mouth disease, exists among live stock in the following-named counties of the State of Pennsylvania:

COLUMBIA, MONTOUR, NORTHUMBERLAND, AND UNION.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following area, to wit:

All territory situated within the boundaries of the counties of Columbia, Montour, Northumberland, and Union, in the State of Pennsylvania.

It is hereby ordered by this Rule 6, under the authority and discretion conferred upon the Secretary of Agriculture by section 2 of the act of Congress approved February 2, 1903, that cattle, sheep, swine, and goats may be shipped interstate, by rail, into the counties of Columbia, Montour, Northumberland, and Union, in the State of Pennsylvania, for purposes of immediate slaughter, and only for such purpose, subject to the restriction hereinafter contained.

The interstate shipment, movement, or trailing or driving of cattle, sheep, swine, and goats into or from the said counties in the State of Pennsylvania, except as hereinbefore provided, is forbidden during the existence of this quarantine.

When animals are shipped interstate by rail into the counties of Columbia, Montour, Northumberland, and Union, in the State of Pennsylvania, for purposes of immediate slaughter, the cars shall be placarded and the waybills shall be stamped plainly to show the purpose for which the shipment is made.

This Rule 6 is subject to amendment or revision on statutory notice.

Done at Washington this twelfth day of November, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

B. A. I. ORDER 156.

Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after November 19, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease, known as foot-and-mouth disease, exists among live stock in the States of Pennsylvania and New York.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following area, to wit:

The States of PENNSYLVANIA and NEW YORK.

During the existence of this quarantine the interstate or foreign transportation, movement, or trailing or driving of cattle, sheep, other ruminants, and swine from the States of Pennsylvania and New York is prohibited.

When shipments by rail of cattle, sheep, other ruminants, and swine are made from and to points not included in the territory herein quarantined for foot-and-mouth disease, the said shipments shall not be unloaded within the quarantined territory, except when the animals are unloaded en route, as hereinafter provided, for purposes of feed, rest, and water, as required by the act of Congress of June 29, 1906 (34 Stat., 607). Such unloading shall be into pens or yards which have been specially cleaned and disinfected for the purpose, under the supervision of an employee of the Bureau of Animal Industry, and which have been specially designated and approved for that purpose by the Chief of the Bureau of Animal Industry.

When shipments by rail of cattle, sheep, other ruminants, and swine are made from and to points not included in the area herein quarantined for foot-and-mouth disease, the cars containing the live stock shall be sealed by an employee of the Bureau of Animal Industry before the cars enter the said area; and when such shipments are unloaded en route, within the said area, in cleaned and disinfected pens, for the purposes of feed, rest, and water, as hereinbefore provided, the cars shall, after reloading, be again sealed by an employee of the Bureau of Animal Industry, it being the purpose and intent of this provision that cars containing such shipments shall remain sealed during the time they are passing through the quarantined area, except when broken for the purpose of unloading for feed, rest, and water.

Under authority conferred by section 2 of the act of Congress approved February 3, 1903 (32 Stat., 791), shipments of dressed carcasses of calves, sheep, and other ruminants, interstate or to foreign countries, from a point in the territory herein quarantined are prohibited, unless the hides or skins and hoofs are removed from the carcasses; and the interstate or foreign transportation of hides, skins, and hoofs of cattle, sheep, and other ruminants, and of hay, straw, or similar fodder, from a point in the quarantined territory, is absolutely prohibited unless the said hides, skins, and hoofs of cattle, sheep, and other ruminants, and all hay, straw, or similar fodder be disinfected prior to shipment under the supervision of an inspector of the Bureau of Animal Industry.

No railroad cars or boats, within the area herein quarantined, which have carried live stock, shall be moved interstate until the said cars or boats have been cleaned and disinfected with a 5 per cent solution of carbolic acid.

Rule 6, dated November 12, 1908, effective on and after November 13, 1908, shall cease to be effective on and after November 19, 1908, on and after which date this Rule 6, Revision 1, which for purposes of identification is designated as B. A. I. Order 156, and which is subject to amendment or revision on statutory notice, shall become and be effective until otherwise ordered.

Done at Washington this nineteenth day of November, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 1 TO B. A. I. ORDER 156.

Amendment 1 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after November 25, 1908, at 6 o'clock a. m.).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease, known as foot-and-mouth disease, exists among live stock in the State of Michigan.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following area, to wit:

The State of MICHIGAN.

During the existence of this quarantine the interstate or foreign transportation, movement, or trailing or driving of cattle, sheep, other ruminants, and swine from the State of Michigan is prohibited.

When shipments by rail of cattle, sheep, other ruminants, and swine are made from and to points not included in the territory herein quarantined for foot-and-mouth disease, the said shipments shall not be unloaded within the quarantined territory, except when the animals are unloaded en route, as hereinafter provided, for purposes of feed, rest, and water, as required by the act of Congress of June 29, 1906 (34 Stat., 607). Such unloading shall be into pens or yards which have been specially cleaned and disinfected for the purpose under the supervision of an employee of the Bureau of Animal Industry, and which have been specially designated and approved for that purpose by the Chief of the Bureau of Animal Industry.

When shipments by rail of cattle, sheep, other ruminants, and swine are made from and to points not included in the area herein quarantined for foot-and-mouth disease, the cars containing the live stock shall be sealed by an employee of the Bureau of Animal Industry before the cars enter the said area; and when such shipments are unloaded en route, within the said area, in cleaned and disinfected pens, for the purposes of feed, rest, and water, as hereinbefore provided, the cars shall, after reloading, be again sealed by an employee of the Bureau of Animal Industry, it being the purpose and intent of this provision that cars containing such shipments shall remain sealed during the time they are passing through the quarantined area, except when broken for the purpose of unloading for feed, rest, and water.

Under authority conferred by section 2 of the act of Congress approved February 3, 1903 (32 Stat., 791), shipments of dressed carcasses of calves, sheep, and other ruminants, interstate or to foreign countries, from a point in the territory herein quarantined are prohibited, unless the hides or skins and hoofs are removed from the carcasses; and the interstate or foreign transportation of hides, skins, and hoofs of cattle, sheep, and other ruminants, and of hay, straw, or similar fodder from a point in the quarantined territory is absolutely prohibited unless the said hides, skins, and hoofs of cattle, sheep, and other ruminants, and all hay, straw, or similar fodder be disinfected prior to shipment under the supervision of an inspector of the Bureau of Animal Industry.

No railroad cars or boats, within the area herein quarantined, which have carried live stock shall be moved interstate until the said cars or boats have been cleaned and disinfected with a 5 per cent solution of carbolic acid.

This amendment is effective on and after November 25, 1908, at 6 o'clock a. m., and is subject to amendment or revision on statutory notice.

Done at Detroit, Mich., this twenty-fourth day of November, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 2 TO B. A. I. ORDER 156.

Amendment 2 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after November 25, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

By the provisions of Rule 6, Revision 1, which establishes a quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, under authority conferred by section 2 of the act of Congress approved February 2, 1903 (32 Stat., 791), interstate or foreign transportation of hides and skins from a point in the quarantined area is absolutely prohibited unless said hides and skins are disinfected prior to shipment under the supervision of an inspector of the Bureau of Animal Industry. This provision is hereby amended in the following particulars:

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto—

1. Imported hides and skins are not required to be disinfected prior to interstate or foreign movement (except to Great Britain) from the area quarantined on account of foot-and-mouth disease, if, upon investigation by an employee of the Bureau of Animal Industry, it develops that there has been no opportunity for such hides or skins to have become infected.

2. Domestic salted hides and skins on hand prior to October 10, 1908, may be moved without disinfection in interstate or foreign commerce (except to Great Britain) from the area quarantined on account of foot-and-mouth disease, if investigation by an employee of the Bureau of Animal Industry shows that there has been no opportunity for such said domestic salted hides and skins to have become infected.

3. Hides and skins which have been removed since October 10, 1908, from the carcasses of the classes of animals affected by the quarantine, and which are within the area quarantined for foot-and-mouth disease shall be immersed in a 5 per cent solution of pure carbolic acid, or a 3 per cent solution of formalin containing a 37 per cent solution of formaldehyde, or a 1 to 1,000 solution of bichlorid of mercury before being moved in interstate or foreign commerce.

4. No hides or skins of the animals affected by the quarantine shall be transported in interstate or foreign commerce until a certificate for each consignment is furnished the carrier by an employee of the Bureau of Animal Industry.

This amendment is effective on and after November 25, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this twenty-fourth day of November, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] WILLIS L. MOORE, *Acting Secretary of Agriculture.*

AMENDMENT 3 TO B. A. I. ORDER 156.

Amendment 3 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after November 27, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

The fact has been determined by the Secretary of Agriculture, and notice is hereby given, that a contagious, communicable disease, known as foot-and-mouth disease, exists among live stock in the State of Maryland.

Now, therefore, I, JAMES WILSON, SECRETARY OF AGRICULTURE, under authority conferred by section 1 of the act of Congress approved March 3, 1905 (33 Stat., 864), do hereby quarantine the following area, to wit:

The State of MARYLAND.

During the existence of this quarantine the interstate or foreign transportation, movement, or trailing or driving of cattle, sheep, other ruminants, and swine from the State of Maryland is prohibited. The term interstate as used herein includes a shipment or movement into or through the District of Columbia.

When shipments by rail of cattle, sheep, other ruminants, and swine are made from and to points not included in the territory herein quarantined for foot-and-mouth disease, the said shipments shall not be unloaded within the quarantined territory except when the animals are unloaded en route, as hereinafter provided, for purposes of feed, rest, and water, as required by the act of Congress of June 29, 1906 (34 Stat., 607). Such unloading shall be into pens or yards which have been specially cleaned and disinfected

for the purpose under the supervision of an employee of the Bureau of Animal Industry, and which have been specially designated and approved for that purpose by the Chief of the Bureau of Animal Industry.

When shipments by rail of cattle, sheep, other ruminants, and swine are made from and to points not included in the area herein quarantined for foot-and-mouth disease, the cars containing the live stock shall be sealed by an employee of the Bureau of Animal Industry before the cars enter the said area; and when such shipments are unloaded en route within the said area in clean and disinfected pens for the purposes of feed, rest, and water, as hereinbefore provided, the cars shall, after reloading, be again sealed by an employee of the Bureau of Animal Industry, it being the purpose and intent of this provision that cars containing such shipments shall remain sealed during the time they are passing through the quarantined area, except when broken for the purpose of unloading for feed, rest, and water.

Under authority conferred by section 2 of the act of Congress approved February 3, 1903 (32 Stat., 791), shipments of dressed carcasses of calves, sheep, and other ruminants, interstate or to foreign countries, from a point in the territory herein quarantined are prohibited unless the hides or skins and hoofs are removed from the carcasses; and the interstate or foreign transportation of hoofs of cattle, sheep, and other ruminants, and of hay, straw, or similar fodder from a point in the quarantined territory is absolutely prohibited unless the said hoofs of cattle, sheep, and other ruminants, and all hay, straw, or similar fodder be disinfected prior to shipment under the supervision of an inspector of the Bureau of Animal Industry. The shipment of hides and skins of cattle, sheep, and other ruminants from Maryland, interstate or foreign, will be governed by the terms of Rule 6, Revision 1, and amendment 2 thereto.

No railroad cars or boats, within the area herein quarantined, which have carried live stock shall be moved interstate until the said cars or boats have been cleaned and disinfected with a 5 per cent solution of carbolic acid.

This amendment is effective on and after November 27, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this twenty-seventh day of November, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 4 TO B. A. I. ORDER 156.

Amendment 4 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after December 2, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, calves, sheep, other ruminants, and swine may be shipped interstate by rail from a point not in the area quarantined by Rule 6, Revision 1, and amendments thereto, for foot-and-mouth disease, through the said quarantined area to a point not in the said quarantined area in unsealed cars if each animal is crated securely. The carcasses of calves, sheep, and other ruminants, with the hide, skin, or hoofs attached, may be shipped interstate by rail from a point not in the area quarantined by Rule 6, Revision 1, and amendments thereto, for foot-and-mouth disease, through the said quarantined area to a point not in the said quarantined area in unsealed cars if each carcass is crated securely.

When shipments of animals or carcasses in crates are made under the terms of this amendment there shall be securely affixed to each crate a card or paster showing the origin and destination of the shipment.

Hay, straw, or similar fodder not originating in a State quarantined for foot-and-mouth disease and shipped into such State, there to be used for packing purposes, may be moved interstate from the area quarantined on account of foot-and-mouth disease without disinfection when used solely for packing purposes, if upon investigation it is shown that there has been no opportunity for the said hay, straw, or similar fodder to have become infected, provided that such shipments are accompanied by a certificate to that effect issued by an employee of the Bureau of Animal Industry.

Rule 6, Revision 1, and amendments thereto, numbered, respectively, 1, 2, and 3, are hereby amended accordingly.

This amendment is effective on and after December 2, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this second day of December, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 5 TO B. A. I. ORDER 156.

Amendment 5 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Diseases in Cattle, Sheep, other Ruminants, and Swine (Effective on and after December 15, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, shipments may be made by rail of hay, straw, or similar fodder, and of hides, skins, and hoofs of cattle, sheep, and other ruminants which originate in a quarantined State, destined to another point in the same State, but which, through the exigencies of travel, are transported through adjacent States, provided that such shipments are not unloaded en route in any State other than the State of origin, except in certain yards or sheds to be designated by the Chief of the Bureau of Animal Industry.

Shipments may therefore be made as above specified without disinfection and without certification by the Bureau of Animal Industry.

Rule 6, Revision 1, and amendments thereto, numbered, respectively, 1, 2, 3, and 4, are hereby amended accordingly.

This amendment is effective on and after December 15, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this fifteenth day of December, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 6 TO B. A. I. ORDER 156.

Amendment 6 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after December 19, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, particularly Amendment 3, quarantining the State of Maryland, cattle, calves, sheep, and swine may be shipped interstate by rail or boat, or be trailed or driven, from any point in the State of Maryland, except from Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12 in Carroll County, and Districts 4, 5, 6, 7, 8, and 10 in Baltimore County, for immediate slaughter to any point located in any other State or Territory or the District of Columbia without inspection or certification, provided the authorities of the State, Territory, or the District of Columbia to which the animals are destined have previously signified their willingness to accept such animals. When such animals are received from points in Maryland they shall be slaughtered immediately.

Animals moved under this amendment shall not be trailed into or driven through the said Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12 in Carroll County, and Districts 4, 5, 6, 7, 8, and 10 in Baltimore County, Md. If shipped by rail through the said counties they shall not be unloaded therein, nor shall animals from the State of Maryland be unloaded en route into cleaned and disinfected pens specially designated by the Chief of the Bureau of Animal Industry, under Rule 6, Revision 1, for the yarding of cattle passing through the quarantined area.

Hay, straw, or similar fodder, including that used for packing merchandise, may be moved interstate from the State of Maryland, except from the said Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12 in Carroll County, and Districts 4, 5, 6, 7, 8, and 10 in Baltimore County, Md., without disinfection or certification, under the applicable restrictions above indicated for shipments of animals.

Hides, skins, and hoofs of cattle, sheep, other ruminants, and swine taken from animals slaughtered at any point in the State of Maryland, except points located in the said Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12 in Carroll County, and Districts 4, 5, 6, 7, 8, and 10 in Baltimore County, Md., may be moved interstate without disinfection or certification, subject to the consent of the officials of the State, Territory, or District to which such shipments are destined.

This amendment is effective on and after December 19, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this nineteenth day of December, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 7 TO B. A. I. ORDER 156.

Amendment 7 to Rule 6, Revision 1.—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after December 24, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, particularly Amendment 1, quarantining the State of Michigan, cattle, calves, sheep, and swine may be shipped interstate by rail or boat, or be trailed or driven under the restrictions hereinafter indicated, from any point in the State of Michigan, except from the counties of Macomb, Oakland, Wayne, Washtenaw, and Monroe, for immediate slaughter, to any point located in any other State or Territory or the District of Columbia without inspection or certification, provided the authorities of the State, Territory, or the District of Columbia to which the animals are destined have previously signified their willingness to accept such animals. When such animals are received from points in Michigan they shall be slaughtered immediately.

Animals moved under this amendment shall not be trailed into or driven through any one of the said counties of Macomb, Oakland, Wayne, Washtenaw, and Monroe, Mich. No cattle, sheep, other ruminants, or swine shall be trailed or driven from the State of Michigan until permission for such movement has first been obtained from the Chief of the Bureau of Animal Industry. When such animals are shipped by rail or boat they shall not be unloaded en route either at points within or without the area quarantined for foot-and-mouth disease, except into pens designated for that purpose by the Chief of the Bureau of Animal Industry. Animals from the State of Michigan shall not be unloaded into cleaned and disinfected pens specially designated by the Chief of the Bureau of Animal Industry under Rule 6, Revision 1, for the yarding of live stock passing through the quarantined area.

Railroad cars or boats within that portion of Michigan not included in the counties of Macomb, Oakland, Wayne, Washtenaw, and Monroe, which have carried live stock, may be moved interstate without being cleaned and disinfected.

Hay, straw, or similar fodder, including that used for packing merchandise, may be moved interstate from the State of Michigan, except from the counties of Macomb, Oakland, Wayne, Washtenaw, and Monroe, without disinfection or certification, under the applicable restrictions above indicated for shipments of animals.

Hides, skins, and hoofs of cattle, sheep, other ruminants, and swine taken from animals slaughtered at any point in the State of Michigan, except points located in the counties of Macomb, Oakland, Wayne, Washtenaw, and Monroe, may be moved interstate without disinfection or certification, subject to the consent of the officials of the State, Territory, or District to which such shipments are destined.

Amendment 6 to Rule 6, Revision 1, modifying the quarantine for the State of Maryland, is hereby amended to provide that animals moved under said Amendment 6 shall not be trailed or driven into or through any one of the Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12 in Carroll County, and Districts 4, 5, 6, 7, 8, and 10 in Baltimore County, Md. No cattle, sheep, other ruminants, or swine shall be trailed or driven from the State of Maryland until permission for such movement has first been obtained from the Chief of the Bureau of Animal Industry. When shipped by rail or boat, animals shipped under Amendment 6 shall not be unloaded en route either at points within or without the area quarantined for foot-and-mouth disease except into pens designated for that purpose by the Chief of the Bureau of Animal Industry. Animals from the State of Maryland shall not be unloaded into cleaned and disinfected pens specially designated by the Chief of the Bureau of Animal Industry under Rule 6, Revision 1, for the yarding of live stock passing through the quarantined area.

Railroad cars or boats within that portion of Maryland not included in Districts 1, 2, 3, 4, 6, 7, 8, 10, 11, and 12 in Carroll County, and Districts 4, 5, 6, 7, 8, and 10 in Baltimore County, which have carried live stock, may be moved interstate without being cleaned and disinfected.

Paragraph 2 of Amendment 6 to Rule 6, Revision 1, is hereby canceled.

This amendment is effective on and after December 24, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this twenty-third day of December, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

AMENDMENT 8 TO B. A. I. ORDER 156.

Amendment 8 to Rule 6, Revision 1—To Prevent the Spread of Foot-and-Mouth Disease in Cattle, Sheep, other Ruminants, and Swine (Effective on and after December 29, 1908).

U. S. DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.

During the existence of the quarantine to prevent the spread of foot-and-mouth disease in cattle, sheep, other ruminants, and swine, as provided in Rule 6, Revision 1, and amendments thereto, quarantining the State of New York, hay, straw, or similar fodder, including that used for packing merchandise, may be moved interstate from the State of New York, except from the counties of Erie, Niagara, Orleans, Genesee, and Monroe, without disinfection or certification, provided the authorities of the State, Territory, or District of Columbia to which the shipments are destined have previously signified their willingness to accept them.

Hides, skins, and hoofs of cattle, sheep, other ruminants, and swine taken from animals slaughtered at any point in the State of New York, except points located in the counties of Erie, Niagara, Orleans, Genesee, and Monroe, may be moved interstate without disinfection or certification, subject to the consent of the officials of the State, Territory, or District to which said shipments are destined.

Shipments may be made of cattle, sheep, other ruminants, and swine, and of the carcasses of said animals with skins and hoofs attached, which originate in a quarantined State destined to another point in the same State, but which, through the exigencies of travel, are transported through adjacent States, and Amendment 5 to Rule 6, Revision 1, is hereby amended accordingly.

This amendment is effective on and after December 29, 1908, and is subject to amendment or revision on statutory notice.

Done at Washington this twenty-eighth day of December, 1908.

Witness my hand and the seal of the Department of Agriculture.

[SEAL.] JAMES WILSON, *Secretary of Agriculture.*

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